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POPULAR AVIATION

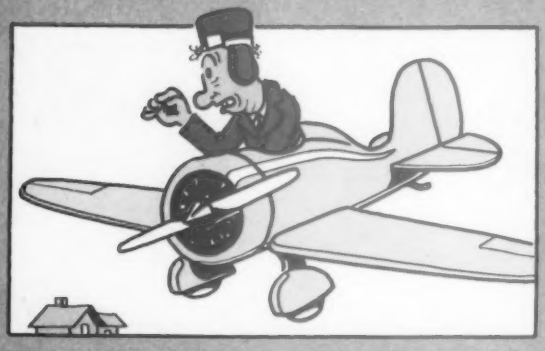
MAY 25c

MR. SMITH TAKES THE AIR — THE STORY OF JAMES STEWART, PILOT

Aerial Gunners in This War ★ Uncle Sam Keeps His Secrets

DON'T BE A SCREWBIRD!

Check Your Tank Before Taking Off . . .
You Can't Walk Back If You Run Out of Gas



Lew Screwbird's looking for a soft spot to land. Why? Well, wouldn't you if you were running out of gas? And that's just what Lew has done . . .

He neglected to check his gasoline supply before taking off. So he had to make an emergency dead-stick landing, and didn't get away with it!

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Issued JULY 17, 1939.

PARKS Receives C.A.A. Certificate No. 1 as an ADVANCED FLYING SCHOOL

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Here's additional proof of the widespread recognition accorded the high standards of training maintained at Parks Air College. The new Air Agency Certificate No. 1, rating Parks as an Advanced Flying School, has just been issued to the College by the Civil Aeronautics Authority.

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Parks Additional Recognition

includes the following: listed in "Accredited Higher Institutions 1938," issued by the Office of Education, U. S. Interior Department; the Aeronautical Engineering School is recognized and approved by the Superintendent of Public Instruction of the State of Illinois; the College is registered by the Illinois Department of Registration and Education.

Parks Air College is approved by both the U. S. Army Air Corps and the U. S. Navy and is cooperating with the Air Corps in giving flight training to flying cadets and aviation mechanics training to enlisted men. Parks graduates fulfill educational requirements for appointment as Flying Cadets in the U. S. Army Air Corps or for appointment to the U. S. Naval Aviation Reserve for flight training.

Even though the C. A. A. standards for approval are now higher than ever before, the scope of the various courses offered at Parks considerably exceeds in content that required for such approval.

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AN EYE-OPENER just has been distributed by the Air Transport Association. It's a comprehensive pamphlet entitled "Little Known Facts About the Scheduled Air Transport Industry". They are little known facts, all right. Peculiarly, it is that little publication that points out just how *small* the airline industry really is in relation to the private flyer and fixed base operator. For instance: of all the airplanes (excluding military) in the United States, the scheduled airlines own 3.1 per cent. The private flyer owns 54.2 per cent. The fixed base operator—he's primarily a private flyer who has expanded to the point of making aviation his business—owns 41.6 per cent of all U. S. commercial aircraft. The remaining 1.1 per cent are C. A. A. and state-owned. Of course, one is inclined to think it unfair to tally all the lightplanes in the country against individual airliners. But let the Air Transport Association continue: as of January 1, 1939, 36.5 per cent of the total mileage flown was by private flyers and non-scheduled aircraft—compared to 19.6 per cent for the airlines. Biggest reason why these are little known facts is that the airlines get a thousand per cent more publicity than the private flyer. To prove this, ask a friend how many airliners he thinks there are in the United States today. His answer will be in the thousands. Actually, there are exactly 353.

* * *

WHICH brings us to a highly important factor the aviation industry as a whole tends to ignore: public relations. With very few exceptions, the publicity or public relations or news departments—the titles all mean the same thing—are notoriously bad. Among private aircraft manufacturers this neglect is very widespread. Offhand we can think of a tiny handful of wide-awake, news-wise publicity men in the whole private aircraft industry. Yet those manufacturers are striving to sell the general public—with whom they apparently don't think it necessary to have any contact. Our job here on POPULAR AVIATION is to interest the *average man* on flying as a utility and sport. In order to do this we naturally must get as much concrete cooperation as we can from those manufacturers who have it. The results? Well, one of the leading builders of private aircraft in this country has "been gathering material" on a transcontinental tour made by one of its products *for more than a year*. And we had to tell that manufacturer that the article was valuable *to him* in the first place. He, like practically all the others, just didn't know it. Con-

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Trade-mark Registered

Volume XXVI Number 5

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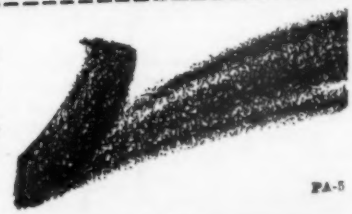

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Mr. Lusk writes out of a background of many years experience. He holds C.A.A. Certificates as a Commercial Pilot—Instructor Rating, and as an Aircraft and Aircraft Engine Mechanic. He is an Associate Fellow, Institute of the Aeronautical Sciences; a Member, Society of Automotive Engineers.

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The equipment required on aircraft certificated for instrument flying is given and some of the new meteorological devices such as the teletype sequence reports are explained. Procedure to decode the Teletype weather reports is presented.

Also of special interest is material on loads and stresses required by the C.A.A. for mechanic's examinations, on sheet metal riveting, bend allowance calculations, detailed information on aircraft aluminum alloys—including Alclad, nonicing automatic mixture control carburetors, new type magnetos, pressure lubricated valve overhead mechanism, two-step superchargers.

Procedure to determine center of gravity location after new equipment has been added to an airplane, is explained.

Although the outline of contents printed below is incomplete and greatly condensed, it will give you an idea of the tremendous range of information GENERAL AERONAUTICS offers you.

OUTLINE OF CONTENTS
(Greatly Condensed)

Principles of Flight: Flight theory. Modern theories of lift. High-lift devices: slots, flaps. Center-of-pressure movement. Aircraft drag and power required. Airplane flutter. Counterbalanced controls. Trimming tabs. Airplane balance; stability, control. Wing, power loading.

Construction of Airplanes: Essential components of airplanes. Tricycle landing gears. Weight, loads, load factors. C.g. determination after adding new equipment. Stresses on plane parts: compression, tension, shear, bending, torsion. S.A.E., stainless steels. Aluminum alloys. Alclad. Riveting metal airplanes; forming labor head. Bend allowance for forming metal parts. Wood, fabric, welded steel construction. Repairing ribs. Tube, spar, cable splicing. Fabric lacing, sewing. Doping, finishing. Assembly precautions.

Operation of Airplanes: Piloting principles. Flight procedure. Take-off, landing. Turns. Figure eights. Side slips. Forced landings. Flying in rough air. Icing conditions.

Propellers: Theory. Construction and maintenance of wood, steel, duraluminum propellers. Variable pitch, constant speed, reversible pitch propellers.

Engine Principles: Theory of internal combustion engines. Otto, Diesel cycles. Compression ratio, efficiency. Octane rating. Manifold pressure. Supercharging. Lubrication theory. Flash point. Viscosity. Brake, indicated horsepower. Brake mean effective pressure.

Engine Construction, Operation: Radial, inline engines. Construction of modern engines. Operating factors. Fuel, lubrication, cooling, ignition systems. Inspection, maintenance requirements. Practical operating procedure.

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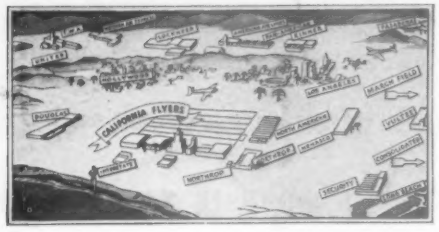

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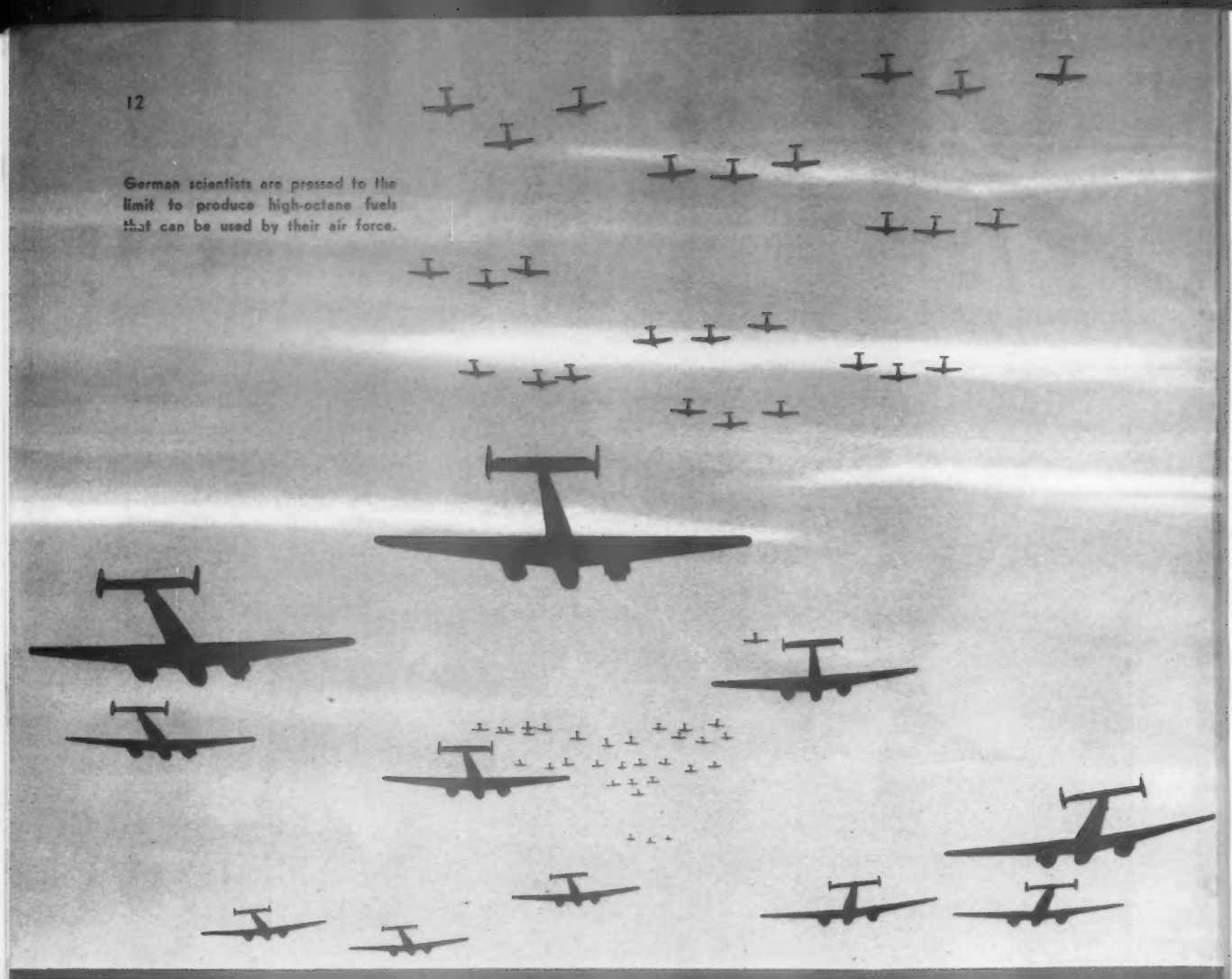


German scientists are pressed to the limit to produce high-octane fuels that can be used by their air force.

ERSATZ DOES IT

by B. ORCHARD LISLE

Consulting petroleum technologist

The German air force continues flying despite a lack of oil. Synthetic fuels fill the gap.

CONSENSUS among qualified military experts is that the much-touted Messerschmitt fighter has proved inferior to the American-built Curtiss *Hawks* of the French air force in actual combat, because the German designers had sacrificed maneuverability in order to gain speed. Offhand one might conclude that, as a result of the defeats experienced during the early stages of the European War, future planes constructed will be modifications of this design.

Undoubtedly, some attempt will be made to rectify this fatal weakness, but the extent of the change must be considered a moot point when one bears in mind the basic problems behind any design produced in that country are caused by limitations in type of fuel available —German engineers are not in a position to gain speed through major increases in power units, as are the members of the Franco-British alliance, and must seek to obtain most increases in speed through variations in fuselage design, etc. In view of the country's fuel supply problem, however, the Reich has already accomplished many wonders.

Germany never did have any considerable resources of petroleum, while the Armistice resulted in the loss of Pechelbronn oil fields to France. It has been an upward struggle: in 1920 she produced 33,702 tons of crude oil which, by dint of improved recovery methods and new discoveries, was raised to 159,-057 tons in 1930. Nothing daunted, German engineers worked on until last year the country had an estimated output of 778,000 tons, exclusive of the probable production of 176,000 tons available from Hitler's Polish acquisition.

Even as they were thus increasing the country's output of natural mineral oil, Nazi economists foresaw that these prodigious efforts would never do much more than slightly exceed 10 per cent of their rapidly growing oil consumption. So they proceeded to seek other methods by which they could make up the deficit. Development of substitute fuels followed, of which the most important have been those derived from coal. This pro-

These Heinkel He-111K bombers use comparatively low-test gasoline or oil-burning Diesel engines.

gram, which has gained impetus during the last half of the decade just completed, has done more toward making Germany self-sufficient in fuel supplies than any other measure and still offers room for expansion.

During the three years spent in Europe by the writer he had an opportunity to collect some interesting data on the Reich's liquid fuel autarchy and has more recently gone into the question as to what extent may Germany be expected to meet her wartime requirements of aviation gasoline through the production of substitute fuels.

There is no gainsaying that, with the exception of limited imports of refined products from Rumania and even smaller quantities (extremely poor in quality) from Soviet Russia, the Reich is dependent on synthesis for its gasoline supplies. The petroleum producing areas under the swastika provide a type of crude which is primarily suited for the manufacture of lubricating petroleum.

Major George Fielding Eliot has stated that if Germany has any chance to win this war by fighting, its air force will of necessity be the principal arm upon which it must depend for success. Its military forces are equaled on land and outnumbered on the sea—only in the air does it claim numerical superiority, a superiority which may be ebbing away with every day that passes. But any superiority in planes must obviously be dependent on its ability to provide adequate supplies of fuel suitable to power them.

Because of the mass air raids threatened by General Goering, quantity available is the first consideration in relation to the consumption of the German air force under present wartime conditions. There are about a half-dozen different sources of synthetic gasolines in Germany, but not all of them produce a product sufficiently high in quality for aviation use, although good enough for overland motorized transport. With early completion of the coal-oil plants under construction during the past year or so ago, hydrogenation of coal by the Bergius process should be increased to an annual yield of 1,820,000 tons of gasoline suitable for aviation blending stock. The 750,000 tons produced each year by Fischer-Tropsch synthesis is too low in grade for such a use, but another 680,000 tons per annum is provided by distillation of brown coal and coal tar cracking while gas works supply some 400,000 tons of benzol. Thus the annual production of suitable gasoline is in the neighborhood of 2,900,000 tons per year or a daily average of some 7,945 tons, not deducting the demands of the

The German air force is using 2,000 tons of gasoline daily on war duties. This is an older Heinkel He-111 being refueled.

motorized cavalry which would exceed the supply of Fischer-Tropsch gasoline.

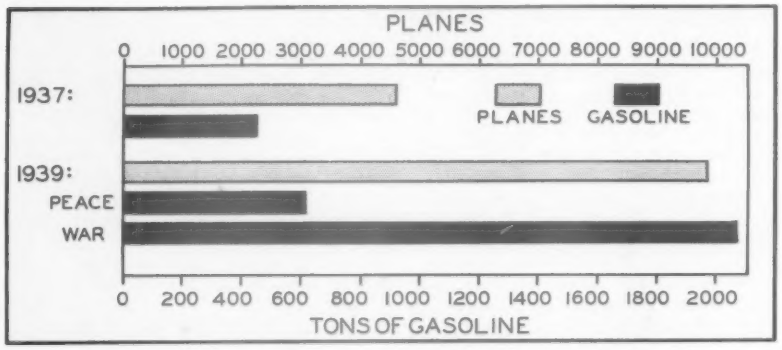
German Air Force*

Heavy bombers	2,000
Light bombers	360
Fighters	1,296
Reconnaissance	400
1st-line reserve, all types	3,056
2nd-line reserve, all types	2,500
Total air force	9,612
Pilots	10,000
Other flying ratings	55,000

**As of outbreak of war.*

According to information made available by Major Dupuy, Germany has some 9,600 or more planes of all categories. Of these, 3,056 are first-line planes in service, backed by a like number of first-line reserve units. Included in the grand total are approximately 2,000 planes powered by Diesel engines, however, that a large proportion of the Reich's air force has been designed with a view to taking off on 87 octane fuel and cruising on 80 octane gasoline by means of separate tanks. This bears in with the anti-knock rating of the motor spirit produced from coal by the Bergius process and by coal tar cracking, which ranges from 70 to 85 octane, dependent upon quantity produced from a given amount of raw material. But addition of dope will raise the anti-knock rating several octanes. However, it is evident that the German air force must operate on fuel appreciably poorer than that available to Britain and France: 75 octane fuel, for example, gives 25 per cent less lift, 35 per cent less power and 20 per cent less speed than the 100 octane fuel used by many Allied planes and to be produced by British and French plants nearing completion.

When operating at maximum capacity the German catalytic hydrogenation plants are understood to produce a motor fuel of 70 to 72 octanes. But should quantity be sacrificed for quality it is possible to manufacture an aviation spirit with an unleaded value of about 85 octanes—which, after treating with a suitable dope, possibly might approach the performance obtained with America's 100 octane gasoline. But the known airplane designs, previously mentioned, would imply that Germany intends to fuel her air armada with the larger volume of gasoline corresponding to American commercial specifications.



This chart on the German air force was prepared for this article by the author.

which have been allowed for in the consumption estimates.

On the basis of information available with regard to oil consumption during the military operations in both Ethiopian and Spanish campaigns, it is apparent that the Nazi air force has probably consumed about 2,000.8 tons of gasoline daily during the first four months of the European war, compared with a peacetime consumption of 602.4 tons daily during the January-August period of 1939. This is still well within the limitations of indigenous oil supplies—for private consumption in Germany no longer exists—but with intensified combat this figure may be trebled. Such would be the case could the Hitler government carry out its threat to send 50 planes over London every hour on the hour, but one must bear also in mind that for some time before the war Germany had been building up emergency reserves of petroleum products, estimated in Paris at 3,000,000 tons, of which an appreciable proportion must be aviation fuel.

While the situation with regard to quality of product is not particularly bright, nevertheless it is not as dark as some would picture it. The trend of military aviation in the United States and, to a lesser extent, in Britain and France, has been to the exclusive use of 100 octane gasoline. An examination of German fighting plane types reveals,

The Reich is able to raise the octane value of her synthetic aviation gasoline because she has facilities for the manufacture of tetra-ethyl lead and other similar dopes suitable for improving the anti-knock qualities of the several varieties of coal spirit.

Satisfactory results also have been obtained outside of the Reich with gasoline substitutes. Britain's Royal Air Force has been using aviation fuel, produced from coal by the low temperature carbonization process, for six or more years. The writer recalls a statement made to him the last time he was in England by an Air Ministry official; it was to the effect that the fuel was first tried out experimentally with a single squadron and that, after its suitability had been proven, its use was extended to seven squadrons. Annual R. A. F. gasoline consumption at that time included some 895,000 gal. (U. S.) of this gasoline, leaded to about 85 octanes, as well as some 828,000 gal. of fuel derived from the benzol output of high temperature gas works.

Dr. Benjamin T. Brooks, consulting chemist, recently stated that "an unknown number of (German) planes have been adapted to use benzine blends, by water cooling, thus enabling them to use some 4,500,000 bbl. of benzine for aviation purposes. It is also known that some of the newer types of motors use the forced-injection method, which is also used in Diesel engines, thus enabling them to use gasolines of a wider range of octane and volatility characteristics to much greater advantage."

Alcohol blends are not satisfactory for general use, and the quantities of gas works benzoil and methanol vary widely in their suitability for aviation consumption.

The Reich leads the world in development of the aviation Diesel engine and an appreciable proportion of her air force is powered by this type of unit. Nazi military economists have estimated (prior to the European War) that Germany's ultimate wartime requirements of Diesel fuel for aviation use at about 1,413,000 tons per annum, but so far there is no indication that consumption of this fuel has exceeded one-tenth of this figure during the first four months of the war.

It is with regard to supply of the necessary Diesel oil for aviation that the Reich's strategists get one of their biggest headaches—for the proportion of this fuel to gasoline produced from coal is comparatively small, while it must be subjected to considerable treatment and doping before it can be used. However, it has been reported from Paris that the Reich had a wartime oil reserve of about 3,000,000 tons, of which it is safe to presume a large proportion must be Diesel fuel.

Late in October of last year Col. Whiston A. Bristow, England's leading coal-oil conversion expert and chairman of the only commercially-successful company in that field, stated that the Reich had in view the production of a very high-grade Diesel oil with a cetene number of 120. He also added that a large quantity of mono-olefines which

(*Continued on page 76*)

PERFORMANCE OF TYPICAL GERMAN PLANES

Plane	Type	Range	Gal./Mi.
Heinkel He-270K	Reconnaisance	1,428 mi.	0.1716*
Heinkel He-270K	Light Bomber	994 mi.	0.2465*
Dornier Do-17	Bomber	1,490 mi.	0.2684*
Blohm & Voss Ha-140	Torpedo-Bomber†, mine-layer	715 mi.	0.3329*
Blohm & Voss Ha-139b	Mailplane‡ (mine-layer?)	3,200 mi.	0.5367§

*Gasoline §Diesel Oil †Twin-engined ‡Four engines

TORPEDO BIRDS

Eight Douglas TBD-1's of the Navy's Torpedo Squadron Two line up for their picture.

REVOLUTION OVER THE FRONT LINES

by

LIEUT.-COL. B. R. S. HEATHERINGTON

The Army has been testing these autogiros for slow flight.

Army Air Corps officers are toying with a radically new type of military airplane. The low-and-slow observation ship is being tested.

THE division's G-2 is in a daze, a happy one. All during the march toward the enemy, his troops had been going along without a hitch. The scout cars, never blundering into a road trap or ambush, had scurried ahead and off to the flank. The marching columns and truckload after truckload, had kept abreast of each other on parallel routes. When they finally ran into the enemy advance guards the news came back to division headquarters without delay.

The news came back via airplane. The planes—some of them anyway—dropped into the hastily converted cow pasture nearby, where G-2 could talk personally with the air observers after each mission and get the complete dope from them. Lots of things the flying men couldn't do, but they made no bones about it. Said they'd be shot down pronto if they ventured low and slow, hovering over the enemy lines. Said they couldn't *all* land everywhere, only about three or four planes in the squadron could do that. The division's staff air officer backed them up, too. Damned nuisance at times, that fellow. Kept running to G-3 to insist on machine gun protection from the ground for his lightplanes whenever an enemy pursuiter showed up in the sky and was full of data on flying and landing characteristics. But aerial observation,—they were getting it this time. Big planes over the enemy lines, smaller planes over their own lines and along the front lines; what one type couldn't do the other could—and *did*.

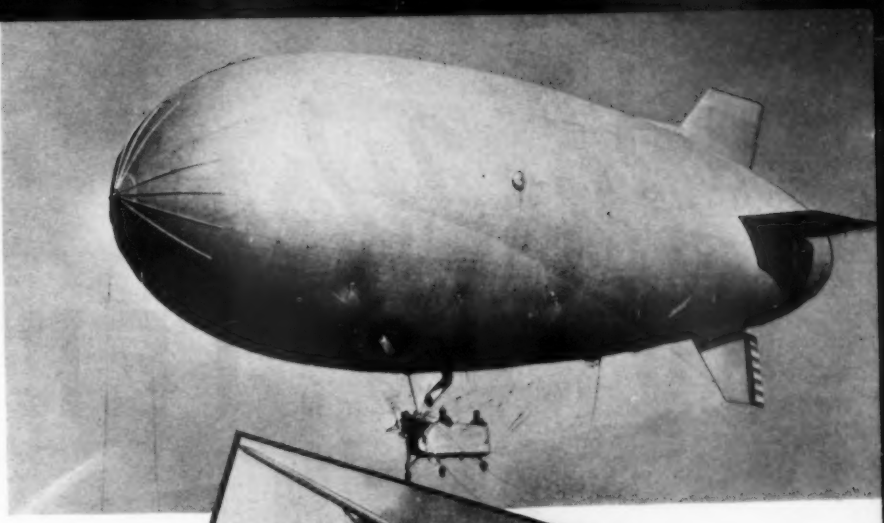
G-2—the Intelligence expert, the staff officer who can tell the commander all about the enemy, maybe—even forgets to bat his skull against the wall like the *enemy* G-2 would like to do, or to glare at the Old Man's aides or to speak crisply to his sergeant chief clerk. Which, the gang around headquarters admits, is revolutionary as far as G-2's usual conduct is concerned. Not that this is the only revolution going on at the time of which we speak. For it appears there's also a revolution brewing *over the front lines;* a revolution of the old system of aerial reconnaissance, contact and liaison work—especially short range work such as artillery adjustment, liaison with our own units up on the firing line and contact with the enemy riflemen and machine gunners facing them.

Hints of this front line aerial revolution (of the near future) came some months ago when the War Department announced it had let three contracts as follows: Stinson Aircraft, Wayne, Mich., for $1,500,000. Bellanca Aircraft Corp., New Castle, Del., for $50,000. Ryan Aeronautical Co., San Diego, Cal., for $50,000.

The contracts were for short-range observation airplanes particularly adapted to contact in infantry liaison work and aerial adjustment of artillery fire and primarily suited for the aerial service of the infantry division. The planes are to be two-place, single-engined monoplanes with full radio equipment; with flaps, steerable tail wheels and other devices tending to improve maneuverability tnd performance.

When the contract was let it did not get much publicity from the daily press, which happened to be playing up big bombers and the like whenever military air matters were mentioned. Almost unnoticed by the press was a later announcement that an additional contract for observation planes had been let, this time to the Curtiss-Wright Co., of Buffalo, N. Y., for $5,000,000. This too was for small and light observation planes; they also have a transparent sliding canopy over pilot and observer.

All these planes are high-wing, externally-braced monoplanes—or started out to be that type. The Curtiss job has retractable landing gear and a 420 h.p. Pratt and Whitney engine. The Ryans



Another new Army observation adjunct is this small blimp with detachable gondola.

and Bellancas also are to have Pratt and Whitneys, while the Stinsons will be powered with Lycomings of the R680-9 type delivering 280 h.p. at sea level.

The War Department announcement is unusually and refreshingly frank. That's almost revolutionary in itself, some newsmen say. Quoting the announcement:

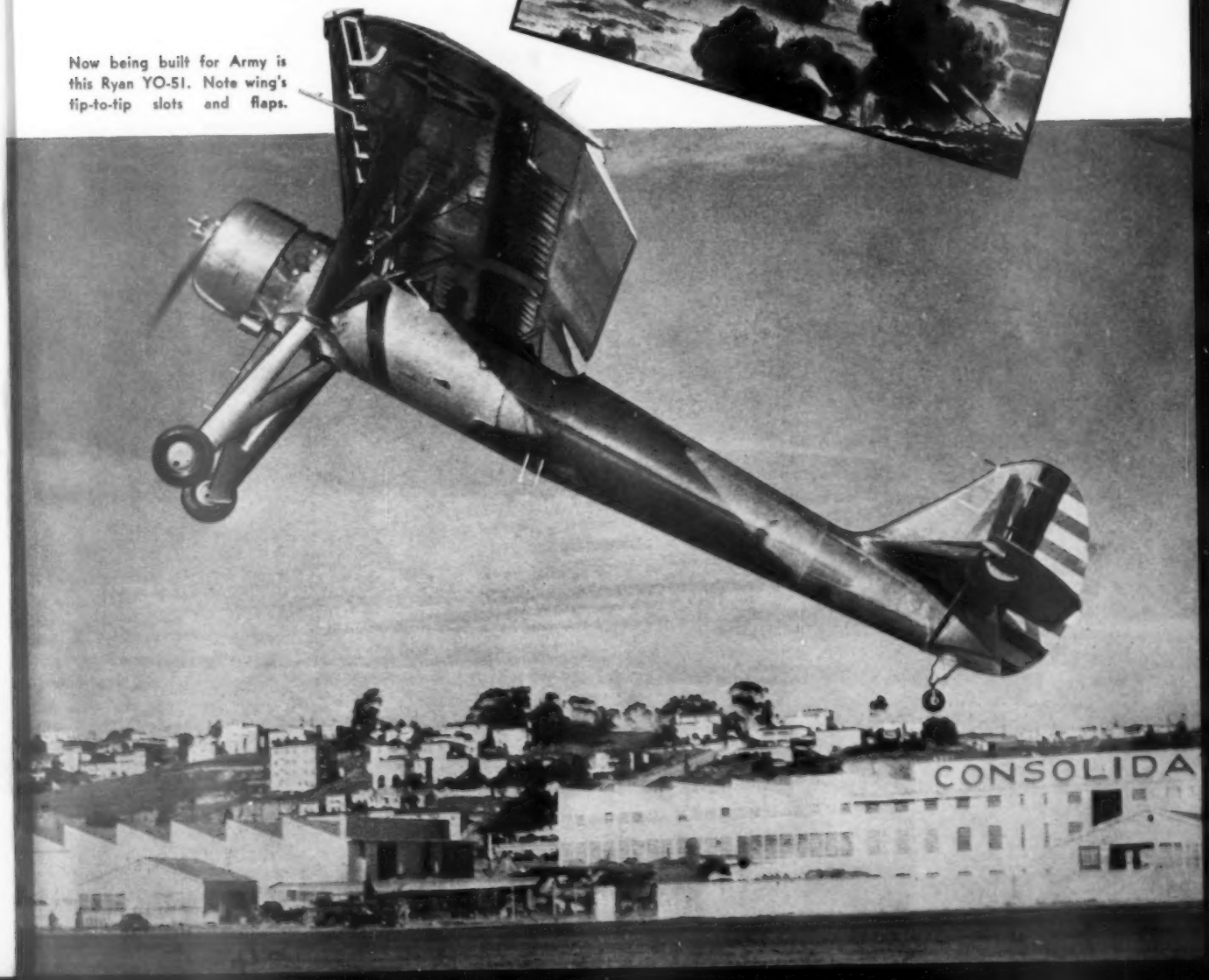
"The tendency in corps and division observation planes has been toward larger size and greater speed. Such planes were unable to use the small fields usually found in the division areas and, for other reasons, *(wonder what they could be?—Author)* the present corps and Army plane has not proven essentially adapted to the work of the Infantry Division."

By the "present corps and Army plane" they mean the North American O-47 type, fast and with good range and fair visibility—but nothing for close work over the tree tops at low speed and absolutely not for landing in and getting out of cow pastures and muddy fields close to the normal wartime division

(*Continued on page 66*)

Sketch at right is of new Stinson observation type.

Now being built for Army is this Ryan YO-51. Note wing's tip-to-tip slots and flaps.



The War's FORGOTTEN MEN

by Leonard Engel

The glassed-in turret of the modern bomber houses one of the bravest flying men in the current war: the aerial machine gunner

EVER since the Wright brothers taught themselves to fly a world that loves its heroes has idolized the man with the stick between his knees. The blood and thunder of World War I put a crimson halo around his head. Today World War II does the same although the modern warplane has made a dodo of the ace.

But there is a forgotten man in this war. Ask the air force trooper: whose task is most grim, whose risk the greatest? Greasemonkey or pilot, mess secretary or staff officer, his answer will be the same. The fellow who really rates the adjectives is not one of themselves. He is the rear gunner, dynamo of the machine gun sitting in the bomber's tail.

He it is who must sit hour after hour, from mission's beginning to journey's end, in the freezing cold transparent prison of the turret. There is no room to move; turrets are small to keep down drag and space has more valuable uses than catering to his comfort. Unfailing vigilance is his watchword; he must not fail to see the black shapes in daytime, the searchlight pencils at night that spell defending fighters. When the attack comes, he receives the first blow for he is most exposed. He it is who must keep silent his guns as the enemy roars at him until the enemy, his thrust delivered, bares his broadside for an instant as he wheels away to renew the attack. If the attack occurs on the outward leg the gunner may not even speak his rat-a-tat piece at all. He must spare his bullets for defense when his plane

These British gunners are about to take off on a scouting mission over Germany.

has arrived over its objective and when it is homeward bound, for if attack comes early during a mission it is certain it will come later as well. The air gunner cannot flee, for he is not the man at the helm. If his plane is shot down, more often than not he cannot bail out like his fellows. Turrets are not easy of entrance and exit. Too often to detail individually, a plane has returned, its job well done and pilot and bombardier-observer have stepped out, exhausted, but pleased and unscathed. The gunner is still in his seat—dead at his post. There is no room for him even to slump over.

Air force casualty lists show this picture is no figment of fiction. Though there are fewer gunners than pilots in action, more gunners have been killed in the first six months of war, and the trend is not likely to be reversed. Talk to gunners on leave in Paris and London and see what this has done to them. Danger has given the pilot a don't-give-a-damn attitude as self-defense. Not so the gunner. Horror, instead of danger, is his companion; and horror produces no amusing mask. The gunners, the majority of them, do not want to go back. They all do go back, but not because they like it.

And all this for what reward? A corporal's stripes, no fame, few medals. The cynics know that martial glory is too slippery for most to hold, but it still moves men. Yet the air gunner ranks lower in the European military hierarchy than any other flying personnel. Commissions for air gunners are being introduced in England at last both as reward and inducement as well as tactical reasons, but they are still the exception rather than the rule.

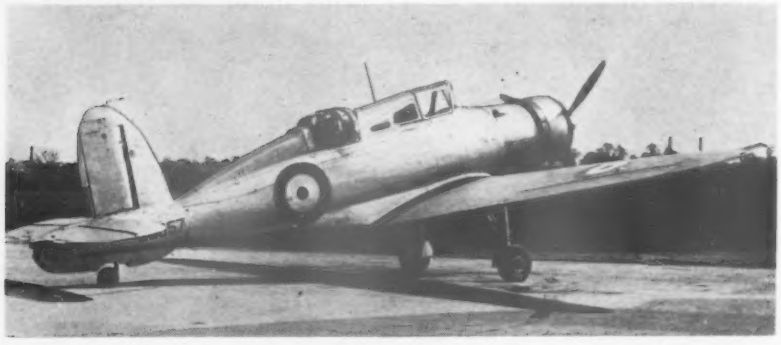
The air gunner's weapons are arranged in a wide variety of forms, differing from bomber to bomber and country to country. America has her fixed and retractable "blisters," Germany her "dustbins," both France and Germany mechanically turned turrets. No one of these is perfect; no form of air armament even begins to approach perfection. But the most highly developed and most effective defensive armament for bombers, because more guns can be handled than by any other arrangement, is the British power turret. The war is showing the British gunner to be the most deadly member of the bomber defenders' fraternity; he owes his efficiency to the fact that he disposes of greater fire power than any of his rivals. German fighters have shot down their share of British bombardment craft, but they have had to pay a higher price in terms of their own planes shot down.

British hydraulic power turrets in service at the start of the war usually carried a pair of machine guns which could be turned to any position desired, subject only to the limitation of interference from other parts of the airplane. Most of the arrangements used by other powers permit the use of only a single machine gun and that one cannot be turned far or rapidly by muscle power in a 300 m.p.h. slipstream. New

Far in the tail of this "Sunderland" flying boat sits a British gunner with a battery of four guns.

Below is the gunner's post in the tail of a British "Wellesley" bomber. Note two guns.

Machine gunners, sitting in nose and tail turrets like those of this big Short patrol boat, are the first targets of enemy aircraft. Gunner casualties are particularly high.



Newest wrinkle developed by the British is the power-driven gun turret shown on the Blackburn "Roc" above. It is the domed hood directly behind the pilot's cockpit.

British heavy bombers and fighters of unusual design are armed with four-gun turrets.

The hydraulic turret, a cumbrous piece of equipment weighing in its most developed form close to 600 pounds without guns, spares, ammunition or gunner, is laid out something like an astronomical observatory. Hydraulic power, with the plane's engine as driver of the pump, rotates the turret. The guns are elevated or lowered by hand; they slide in a slot much like the observatory's telescope slot. Six controls are all the gunner needs in the two-gun turret: a pair of pedals to control rotation, a pair of hand grips for raising and lowering the guns and a pair of thumb buttons—one on each hand grip —for firing.

The turret for firing to the rear is located as far aft as possible in most cases, not only to give the maximum field of fire, but to reduce drag. In the big twin-engined Vickers *Wellington* and Armstrong Whitworth *Whitley* bombers and Short *Sunderland* four-engined flying boat, the rear turret is a part of the tail assembly. In others, like the Bristol *Blenheim*, the turret is located immediately forward of the rudder. The gunner in the *Wellington* and *Whitley* serves full-time at his difficult-to-get-at post; in the others he is also the radio operator. The gunner-radio operator's duties do not conflict with each other.

The standard reflector sight used in most parts of Europe is fitted in the turrets. It is mounted separately from the guns and swings off center to compensate for the effect of the airstream when the guns are fired at an angle or broadside to the direction in which the plane is flying. Like the vane sights used during First World War days, the reflector sight does not calculate the speed of an enemy plane, but the relative speed to the gunner's own ship. But the difficulty a generation ago in coping with variations in the speed of the gunner's plane has not yet been overcome and a constant speed is assumed. Besides gun, sights and controls, the gunner has crowded around him in his turret ammunition drums, a complete set of spare parts and a telephone for speaking to his fellow crew members. Ready for action, a hydraulic turret and its mechanical and human contents weigh almost 1,200 pounds.

Air gunnery takes small, stocky, tough men. And, according to official instructions to recruiting officers which I have been allowed to read but not to copy or quote directly from, air forces do not want gunners with overactive imaginations. It would never do, during strained, motionless hours aloft, to think of the nightmare that may lie ahead. There are perhaps 10,000 trained gunners, each with upwards of three months of training, ready and anxious to shoot it out with each other on both sides of the Western Front. They all are men with unusual qualities of coolness and restraint, yet able to make a quick decision. With attacking planes coming at you two or three at a time and wheeling off in different directions, and so splitting your field of fire, it would not do to take too long to make up your mind which you want to hit. You would end up by hitting no one with your limited ammunition supply.

Exposure of the gunner is one of the drawbacks of the turret as mounted in the tails of Royal Air Force ships. The German Luftwaffe's guns have been moved forward at some sacrifice of field of fire, but the German command feels that the shift has been worth it in gunners saved. The R. A. F. plans no similar change, nor is it apparently particularly interested in development of a remote control arrangement, whereby the turret could be left all the way in the rear and the gunner could be brought forward. He could aim from a retractable cupola. This would not only make escape easier for the gunner if the plane were shot apart, but would reduce the heavy weight in the tail. One air force—I am not at liberty to say which—is currently working out precisely such an arrangement.

Armor-plating the turret has also been suggested, but has been dropped as impractical. It was difficult enough to get a plane to fly with that 1,200-pound weight back in the tail without throwing in an extra 200 pounds for good measure. Led off by France, the belligerents are armoring the cockpits of their fighters today. But if the practice does spread to include bombers, the

(*Continued on page 64*)

Some French bombers still have two-gun braces for gunners, exposed to the air.

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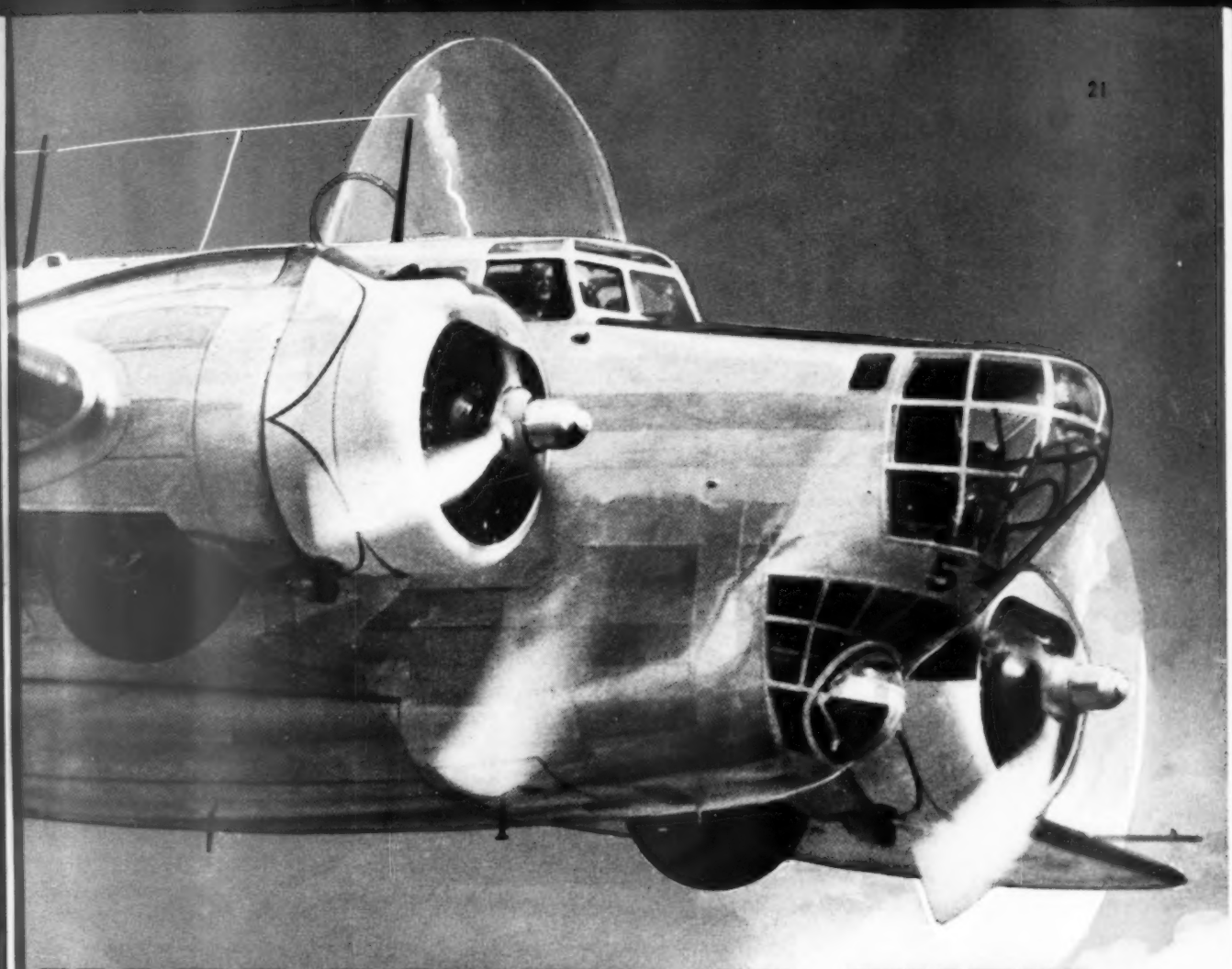


MORE POWER TO THEM

A powerful new aviation gasoline now being tested may revolutionize present-day aircraft.

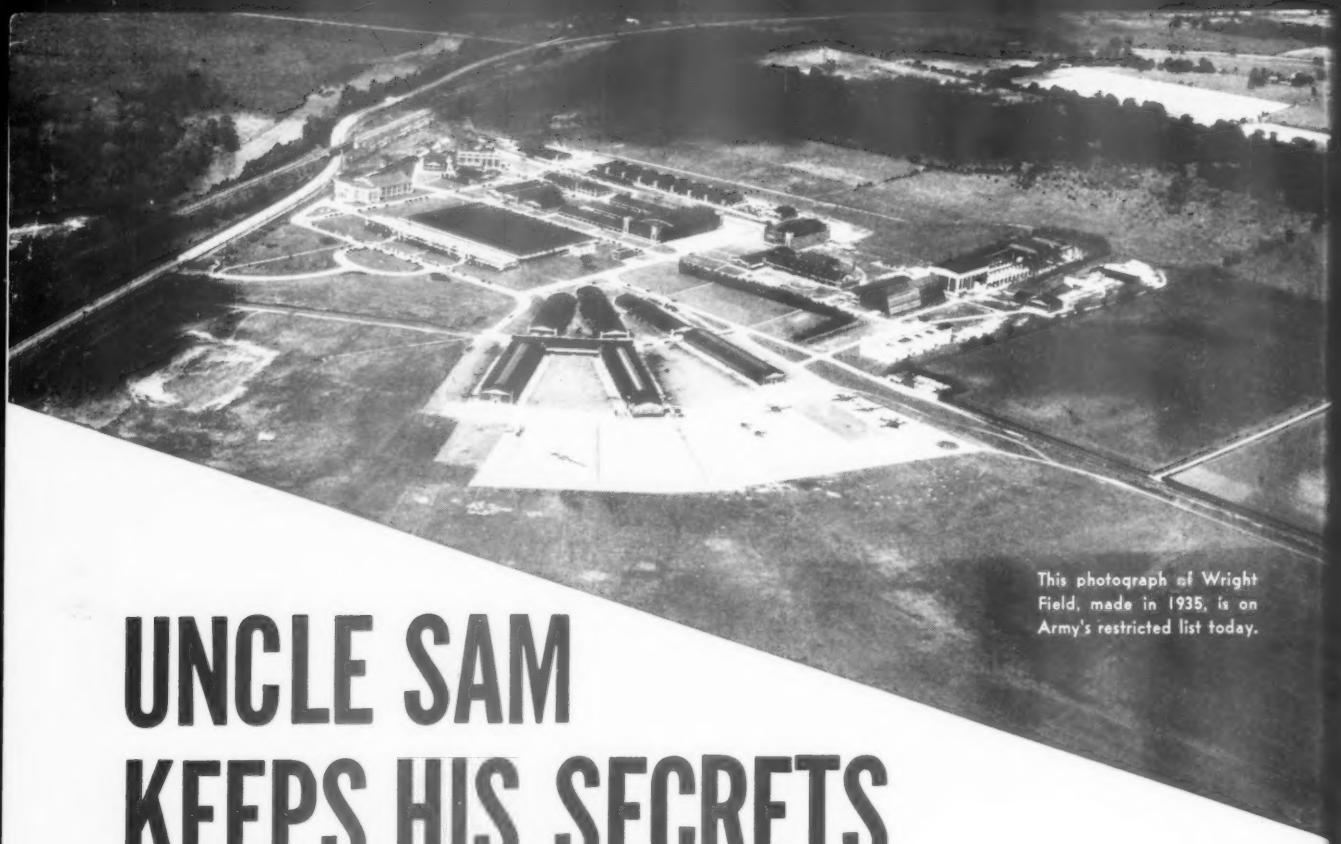
by RICHARD MARTIN

A NEW aviation fuel, soon to be placed on the market in commercial quantities, may be the answer to the problem of more power from airplane engines without an increase in weight or frontal area. The new fuel, recently announced by the Phillips Petroleum Company of Bartlesville, Okla., supplies added power of such extent that its use is equal to adding a third engine to our present two-engine transport planes.

With higher octane, or anti-knock rating than any fuel ever before manufactured, the way is opened for higher compression engines with increased power and no increase in size. Phillips calls this new fuel "Neohexane," a chemical term indicating the nature of the product itself. Roughly translated, the name means "a hydrocarbon fuel composed of molecules containing six carbon atoms in a new and more compact form." The company has announced that this new product can be used to manufacture a motor fuel with a higher octane than has ever been accomplished before.

For a number of years iso-octane, a synthetic fuel made only in small quantities for laboratory purposes, has been considered the perfect motor fuel from the standpoint of anti-knock. It was consequently given an anti knock rating of 100 and has been used as a standard by which all other motor fuels are measured. The ordinary gasoline now used by most automobile drivers has an anti-knock or octane rating of 72. That is, it is 72 per cent as efficient as iso-octane in preventing motor knock. Premium ethyl gasoline has an octane rating of 80, while small airplanes and some of the older model ships now use 72 to 80 octane aviation gasoline. Most modern commercial craft now use a gasoline of 87 octane.

(Continued on page 97)



This photograph of Wright Field, made in 1935, is on Army's restricted list today.

UNCLE SAM KEEPS HIS SECRETS

by BRUCE R. SOUTH

The world wants to know our military aviation secrets. But the U. S. Army Air Corps is playing its cards close.

Pictures taken in aircraft factories must be checked and approved by Army officers.

"IF THEY mean business it's all right, but the whole thing looks fishy to me."

"Yes, and no, boss," replied the engine maker's assistant. "They think they have a better carburetor than ours, that's all. And if they *do* put in a follow-up order for 200 engines, it'll be gravy; we've already written off the development costs on this type. The Army has no objection to unrestricted sale of this engine and these people can and will pay cash, f.o.b."

His boss reluctantly admitted that business was business and gave his okay to the transaction. A week later a party of Snoopvanians was being shown through that part of the factory which was open to the public. They discussed the forthcoming transaction with the factory people as they sauntered along. Three engines to be made—fitted with the new Snoopvanian carburetor, however—and given thorough tests on the factory's stands. If they proved satisfactory an order for 200 engines would follow. No quibbling about the price; as the Americans well knew, the Snoopvanians needed the engines and in a hurry. The four foreigners were reasonable, affable and perfectly above-board. They looked like any four representative businessmen, engineers or inspectors.

A late engine development being kept secret is this Continental wing-submerged engine recently displayed.

One of the four excused himself, going to the washroom. The rest walked on. The absentee walked as if to rejoin them, but turned down another corridor, through a door and onto the assembly floor. He bore no company badge on his lapel, but the mechanics didn't notice. A lot of those engineer guys were careless like that. He walked on and on. Five minutes later he unobtrusively rejoined the party, which was coming to a door with a bright red line painted across its panel, a door leading to the very part of the plant through which this snooping Snoopvanian had been prowling.

"Sorry, but this part's not open to visitors." Their guide, the boss himself, knew they would understand, etc. They did. Everything okay; have to be careful, of course. "Wouldn't do to let the anti-Snoopvanians see too much," one of the party jokingly remarked. Great guys, thought the boss. Nice to do business with. Hope this deal pans out.

That night the four great guys, nice fellows, etc., and two other Snoopvanians were having a knock down and drag out session in a well-guarded room in a nearby city. A snarling vituperative session, in which only one character remained calm, the man against whom they were directing their verbal barbs, the man who had gone through the assembly department. He ended the argument.

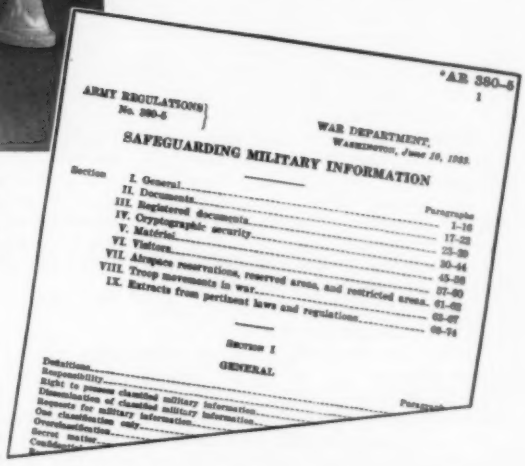
"Gentlemen, I am an actor and a psychologist. I am no engineer and never claimed to be one. I have reported to you all that I saw, confirmed by these pictures I took. I know no more about fuel injectors, starter assemblies, various makes of magnetos and the like. But I will try again; perhaps the camera will make some worthwhile catches in the future. Now here is my plan——."

Is this fiction? Well, perhaps the designation of "Snoopvania" is, but the rest is quite close to fact. The actor-spy, working under duress, learned that his family which had been held as hostages, had escaped from Snoopvania to South America. So did he. So did the others, because they knew he'd blab. Which he did.

Certain authorities took the matter quite calmly. "Let's figure out what the next angle will be," was the comment of their chief. Working in the factory might do the trick. Work*men*—plural? That would mean a conspiracy, an organization, capable of greater damage than an individual, but easier to detect. Just *one* mechanic? It would take a year for him to piece out all the minor bits of information coming his way. Complete drawings? Now, that would be the logical way for those foreigners to get their dope. What'll we do about *that?*

Rest assured that their counter-espionage measures were quite effective. Our authorities, both military and civil, overlook few bets in their aggressive and forehanded campaign to safeguard our air secrets, technical, tactical or strategical. We're quite open and above-board in our rules and regulations concerning the safeguarding of such information. We let everybody, foreigners included, know where we stand officially. And where they get off, officially. You can read about it, as far as the Army Air Corps is concerned, in Army Regulations No. 380-5, which are not secret or confidential, but for sale to the public by the Superintendent of Public Documents in Washington, D. C.

The Army designates all matter not completely open to the public as "classified," which includes secret, confidential or restricted matter, named in the order of their importance. Secret matter is that which, if disclosed, might endanger national security, cause serious injury to the interest or prestige of the nation or any Government activity, or would be of great advantage to a foreign nation.



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ARMY REGULATIONS
No. 380-5

WAR DEPARTMENT,
WASHINGTON, June 10, 1935.

SAFEGUARDING MILITARY INFORMATION

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SECTION I

GENERAL

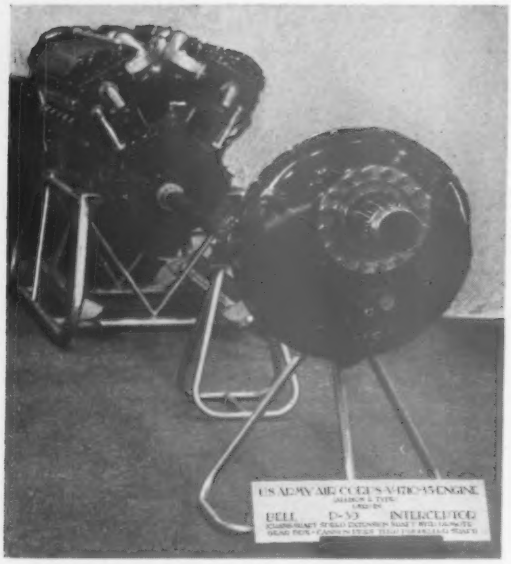
Paragraphs

Definitions
Responsibility
Right to possess classified military information
Dissemination of classified military information
Requests for military information
Oral classification only
Overclassification
Secret matter
Confidential

Regulations concerning military information are strict. All Air Corps officers should be familiar with this booklet.

Coming under this head would be war plans, defense plans, photographs of naval bases and in our overseas possessions, drawings of new materiel of vital importance, or even methods of assembly. Plans for the anti-aircraft defense of the New York or vital industrial area of the northeast would be secret. So would plans of a revolutionary type of airplane or engine.

Not every Tom, Dick or Harry can designate a drawing or plan as secret and have it mean just that. As far as the Army Air Corps is concerned, any Air Corps general or commanding officer of an Army flying field—and, of course, the Chief of the Air Corps and his superiors—can label a thing as secret. Also our air attaches abroad can do so. Information as to the contents or whereabouts of secret matter are disclosed only to



Although this photograph of the engine installation for the Bell XP-39 was released, all details are confidential.

those persons whose duties require such knowledge. Last summer a friend of the author saw standing alongside him in the Aviation Building at the New York World's Fair a young man, a screwball if there ever was one, ostentatiously hugging to his bosom a brief case across the side of which was painted the legend "SECRET DESIGNS, U. S. ARMY AIR CORPS." Some of our readers in the Ohio-Indiana area may have been contacted by the promoter asking for backing in the development of (to use his own words) "this bomb sight and auxiliary devices, which the Air Corps considers so revolutionary, so secret, that I dare show the drawings only to those like you, my friend, who have American air defense at heart." Both the highly imaginative and exhibitionistic youngster at the Fair and the Ohio promoter were obvious phonies.

Confidential or restricted matter is of lesser importance than that classed as secret. In the confidential class may be technical information, such as research of processes of manufacture of propellers, which processes may be a distinct military asset and not a matter of general knowledge but whose disclosure would not really endanger our national security.

Naturally, there are questions which the citizen may ask himself concerning the guarding of our air secrets. "What are the authorities, the Air Corps in particular, doing about this matter," and "where do I come in on it?" Is every Army flying man a snooper working with the F.B.I.? What about the citizen who sits down some evening with a tall glass and a couple of talkative companions and dopes out some plan for the air defense of New York which just happens to coincide with the real McCoy locked away in a War Department safe? Suppose I hear something hot, get an accidental look at some highly experimental job; will I get in trouble by describing it to a newspaper man?

Needless to say, the Air Corps closely safeguards its secret plans, designs and maps. Within the United States, such documents are transmitted by an officer-messenger or courier or by the United States registered mail. Let us suppose that one of our air attaches abroad wished to send a secret report on the military air situation there to Washington. Ordinarily he would use an officer-courier or the diplomatic mail in a locked pouch, but should neither of these two be available he could properly entrust the report to a reliable citizen of the United States, such as an official of another Government department, or the master of a vessel of United States registry. Therefore it is quite possible that the skipper of one of our transoceanic clippers might at this moment of reading have in his custody some document which would cause serious injury to the interests of the United States should it fall into the hands of a foreign nation. (Writers of spy fiction: there's a lead for you.) However, secret documents other than those used by Air Corps personnel in flight are transported by aircraft only under exceptional circumstances, and when so transported they are securely wrapped and placed in the custody of an officer other than the pilot. When the flight is to be made over water the documents are also weighted.

The secret or confidential drawing of an experimental engine would be stored in the most secure files available in a room that is kept locked when not in use. It might be given a register number for use in accounting to some superior officer at periodic intervals, then stored in a three-combination safe and only officers and specially trusted soldiers or civilian employees allowed access to the combination. To play doubly safe, cipher tables, alphabets and keys are not usually kept in the same safe as the code books, documents or cipher devices to which they apply.

The army no longer distributes photos of any of its air bases to the press. There is apparently nothing to legally prevent a citizen from hiring a plane, flying near an Army field and snapping as many photos as he or she desires—provided they are not made for the purpose of aiding a foreign nation. Might be a good idea to look up the provisions of the Espionage Act before deciding to play the wise guy in taking photos or snooping around where the Army doesn't want you. When it becomes necessary in the interests of national defense the President can designate certain air bases or articles of equipment as requiring protection against the general dissemination of information concerning them and any person making an unauthorized sketch or photograph of such a base, airplane, engine or other item of equipment *may* be subject to a $1,000 fine or imprisonment for one year, or both. Even more drastic penalties are involved for *deliberate* acts which might endanger the security of the United States, ranging up to the death penalty in time of war. Of course, no court is going to imprison or slap a huge fine against some youngster or blunderer or illiterate who disregards this sign:

IT IS UNLAWFUL TO ENTER WITHIN THIS HANGAR WITHOUT WRITTEN PERMISSION OF THE COMMANDING OFFICER.

If it is a first offense and there is no evidence of deliberate intent the offender is usually released upon the surrender of any photos or sketches he may have made and after a warning against repetition.

But be careful if, some fine day when you are on a cross-country jaunt and sorta get turned around, you find yourself over the western end of the Aleutian Islands. For reasons of public safety, civil aircraft are forbidden by an Executive Order to operate over them and the same applies to the Aberdeen Proving Grounds in Maryland, Fort Hancock at Sandy Hook, N. J., and the Naval Ammunition Depot at Hingham, Mass., to name some places over which civil aircraft habitually fly in careless and not deliberate violation of the order.

When a contractor engages in technical work for the Air Corps he becomes responsible in matters within his control for the safeguarding of all secret matter which may be disclosed to him or which may be developed in connection with that job. He is usually notified of the pertinent provisions of the Espionage Act, not to scare him, but just to make sure he understands the seriousness of the situation. Whenever it is applicable and practicable to do so dies, models or machines which are given or loaned to a commercial concern are marked as secret or confidential. Prior to furnishing a prospective bidder with drawings or specifications of a secret or confidential nature the bidder signs an agreement to respect their nature and not supply or disclose any information concerning them to an unauthorized person. Aliens are not permitted to have access to them or to the work under construction, nor are they permitted to participate in the contract trials without the written consent beforehand of the Secretary of War. The same applies to the Navy Department.

Of course it is not always possible for the newspaper photographer or the writer to know just what is taboo and what is not. An experimental plane which crashes on an Army field during tests may make lots of headlines and columns of news. Usually the Adjutant at the field will issue a brief statement in connection with the affair, ending up with the stock phrase that "a board of officers is being appointed to investigate the cause of the accident." The commanding officer can prohibit photographers from

(*Continued on page* 84)

H. A. Beilgard has flown his butane-powered monoplane on many trips to prove the fuel's capabilities.

Butane Bus

by KURT RAND

There is an airplane on the west coast today that flies admirably without gasoline. It uses a new fuel that costs just four cents per gallon.

THROUGHOUT this winter and early spring a conventional two-place monoplane has been flying at altitudes up to 14,000 feet on a series of test flights. The ship, a high wing cabin job with a standard Lambert L-266 five-cylinder 90 h.p. radial, has been operating without gasoline.

Its fuel—a liquefied gas with a butane base and containing propane plus an inexpensive formula mix, the nature of which the inventor will not reveal—costs less than four cents a gallon! The liquefied mixture of butane and propane is delivered in 400 gallon lots by Parkhill-Wade, distributors of Shell petroleum products at Los Angeles, at 3½ cents per gallon. The formula mix costs a small fraction of a penny for each gallon, according to the inventor.

The inventor, or developer, is Harvey A. Beilgard of Beverly Hills, Calif., who built his own motor and plane in 1910, learned to pilot it himself at Lake Forest, Ill., and has been flying ever since. Beilgard, who started his remarkable tests with the standard Lambert about four months ago, reports his motive power infinitely superior to gasoline. The liquefied gas weighs but 4.65 pounds per gallon as against better than six pounds for standard fuel. It gives him, he claims, an hour of flying for each four gallons consumed, as against 5½ gallons of gasoline.

"Whereas the Lambert is rated with gasoline at 90 h.p. at 2,375 r.p.m.," Beilgard says, "preliminary tests indicate that I am getting about that output at 2,150 r.p.m.

"The only alterations I have made in the conventional gasoline fuel system consist of a high pressure line to a compensating valve of my own design, which changes the fuel from liquid to gas and a small valve which opens into the intake manifold when the throttle is advanced."

Beilgard and his pilot-mechanic, Edmund Whiting, have toured California from San Diego to San Francisco in the plane. During this period, according to Beilgard, there has been an hourly saving of 16 pounds per hour in fuel weight.

"This is computed on the basis that 73 octane gasoline, used at an hourly rate of 5½ gallons, weighs 34½ pounds as against four gallons of the butane-propane formula weighing 18.6 pounds," Beilgard declares.

Beilgard at present is faced with two problems. The first is the design of a lightweight high tensile steel container for the liquid which, under temperatures ranging from 60° to 100° Fahrenheit, exerts a pressure per square inch of from 40 to 50 pounds. The present tank is of heavy, low grade steel and, while satisfactory, absorbs some of the weight advantage given by the liquefied gas. The second is to reduce the exerted pressure through a perfected chemical mixture.

Beilgard sets forward an amazing list of advantages which his fuel has over gasoline:

"The fuel will not form ice," he says. "It enters the manifold pre-heated by its own change from liquid to gas. The gas, being dry and under pressure, fires immediately at any outside temperature."

He explained that to start the motor a turn of the propeller sufficed, usually.

"Engine performance is increased almost half again, as far as power is concerned," he continued. "It is possible to raise the compression ratio to 12 to 1 in a specially designed motor because of the absence of detonation and pre-combustion."

He declared that he could, by building his own power plant, get 180 h.p. with the same displacement as that of standard current motors developing only 90 h.p. with gasoline.

(*Continued on page 70*)

The many advances in soundproofing have made the sleeper plane a popular success.

QUIET, PLEASE!

by CREIGHTON MERRELL

Soundproofing the modern airplane is a major science in the aviation industry. Here is how one of the big manufacturers handles the job.

PIONEER airline passengers look back at the flying equipment of a mere decade ago and wonder in amazement how they ever endured the discomforts of that era, especially when compared to the luxury they find in the air today. Passengers rode in drafty cabins equipped with stiff-backed seats and few modern conveniences. Food was served box-lunch style by the co-pilot—when he wasn't busy. When night came passengers were put aboard a train to ride until dawn, when they again went into the air.

But the worst complaints were against noise and vibration. Cabin soundproofing and elimination of propeller noises and engine vibrations were matters that had to wait. Passengers boarded the ships, stuffed cotton in their ears, and settled back to endure the monotonous rhythmic beat of the tri-motor's propellers as the r.p.m. of the engines constantly moved in and out of synchronization to produce an ever-changing wave pattern. If you wanted to speak to your fellow passenger, you had to shout lustily into his ear, then wait for him to smile back understandingly.

So busy were aeronautical engineers in those days that they had little time to think about sound problems. It was not until 1931 that attention was first turned seriously to the elimination of noise. Naturally, first attempts were makeshift; merest cut and try methods were involved. In one case as much as 30 lbs. of highly inflammable wool felt per passenger was stuffed in the cabin walls for insulation. The results were not pleasing; the added weight was prohibitive. An early handicap was the fact that many transports still used a composite structure covered with doped fabric—the latter having very little capacity for insulation of the sounds bombarding the cabin from the engines and propellers.

But continuous effort and experimentation by American engineers gradually have insulated cabin noise until now the passenger, instead of shouting, talks in a reasonably subdued voice. In the modern sleeper plane the "quiet please" sign is conspicuous.

Undoubtedly one of the leading pro-

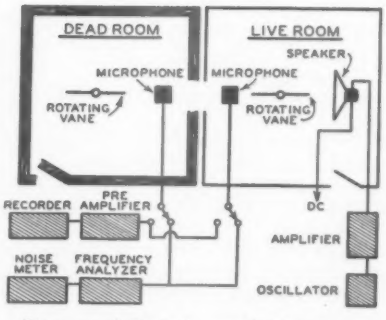
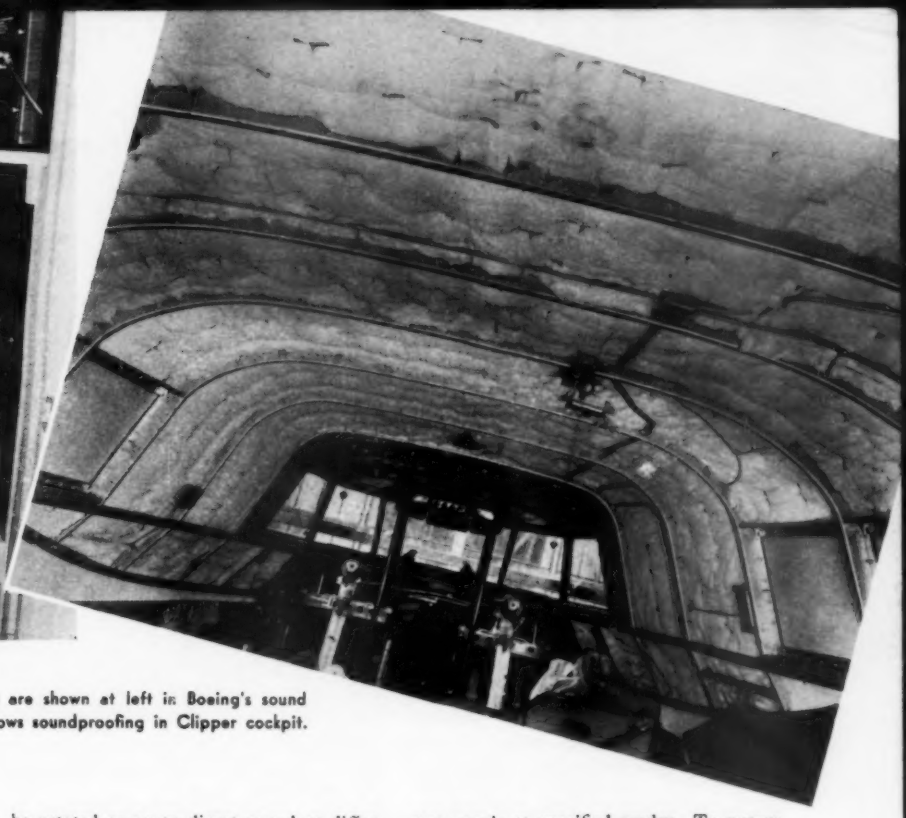


Diagram of Boeing's sound laboratory.



Fred Ross and Dr. Karl Martinez are shown at left in Boeing's sound control room. Picture at right shows soundproofing in Clipper cockpit.

grams of airplane experimental sound research is being conducted by Dr. Karl Martinez, former professor of physics at the University of Washington and now in charge of acoustical engineering for the Boeing Aircraft Company. Working with him are Fred Ross of the Boeing staff and Dr. R. W. Kenworthy and P. M. Higgs of the University of Washington physics department.

Most interesting phase of Martinez's experimentations is the special laboratory set up recently in the university physics building. A joint effort of the Boeing company and the school, the new laboratory is fully equipped to make comprehensive tests and studies of soundproofing and vibration problems. It also will be used by the university for general sound studies.

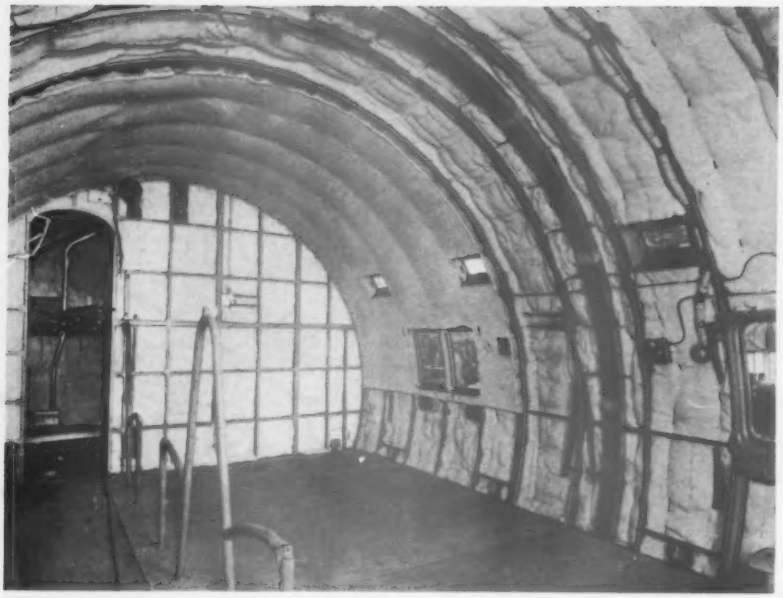
Main items in the laboratory are two sound rooms known as the "live" and "dead" rooms. Both are built of six-inch reinforced concrete walls and are separate units with no structural connection. In addition, each room is built on its own foundation and is inside the main building, but not structurally connected to it in any way. The "live" room is so designed that the walls will reflect all possible sound. To accomplish this a coating of Swedish plaster is used to finish the walls. In the "dead" room the walls are completely lined with layers of special soundproofing material so as to absorb all sound. Each room has a small door through which sound can be led from the "live" to "dead" chambers. Connecting the two doors is a frame designed to prevent leakage of sound.

The "live" chamber contains an 18-inch dynamic speaker, one of the two largest on the West Coast. There also are two panels mounted on bases which permit them to be rotated so as to direct sound at different angles and also to alter the standing wave pattern in the room. A microphone in the "live" room is used to determine the noise level to which the soundproofing sample is being subjected; another mike in the "dead" room picks up the sound which passes through the material.

When a test is made the operators close the air-tight steel doors, sealing the two chambers, and conduct operations from a control room. In this room is a multitude of dials and switches connected to oscillators, amplifiers, noise meters, frequency analyzers, recorders and so forth. In addition to testing sound panels for general noise conditions, apparatus has been developed for directing sound waves at the test panels at specified angles. To accomplish this two five-foot parabolic reflectors are used. One is fitted with a receiver; the other with a mike which faces the concave reflector. The reflectors are set in various positions around an arc, with one directing the sound at the soundproofing material while the other receives the sound which is not absorbed by the material.

A visit to the "live" and "dead" rooms is a unique experience. A person alone in the latter room experiences a very depressed feeling. There is absolute quiet when the apparatus is not in operation. One becomes conscious of slight breathing and heart action sounds in the body. If a word is spoken the sound seems immedi-

Dr. Martinez, in "dead" room, sets microphone in doorway leading to "live" room.



Soundproofing materials above are installed in the latest Boeing "Stratoliner" soon to be delivered to Pan American and TWA. Regular upholstery conceals soundproofing.

"Live" room equipment includes this high output 18-inch speaker for noise-making.

ately to be swallowed up in the blankets of soundproofing which cover every inch of the wall. A person soon realizes how accustomed he has become to the continuous background noise that is a part of his daily life.

The "live" rooms gives a very different sensation when the apparatus is set in motion. The frequency of the sound may be increased from one beat every five seconds to a pitch higher than can be heard by the human ear. The noise level reaches from a whisper up to 140 decibels: exceeding that of a boiler factory. As sound production gets underway, an observer walking around in the room can detect various characteristics of the sound, depending on what zone of the standing wave pattern he is located. As the frequency approaches a critical pitch and amplitude is increased, one experiences a peculiar feeling as the body vibrates all over in unison with the sound. It seems as if one's clothes were creeping over the skin. By application of more amplitude a human being would suffer serious damage to his nervous system which might temporarily or even permanently affect him. While this is taking place the concrete walls actually are fluttering; sufficient energy from the speaker would disintegrate them. Vases have been shattered instantly in experiments.

Excellent results have been reported by Dr. Martinez as data obtained are being put to use in modern aircraft. The procedure followed, roughly, is to figure out on paper noise conditions which occur at various parts of the airplane cabin. Then a test sample is set up in the laboratory and subjected to the same kind of conditions that are found in the air. After measurements are taken to determine the best soundproofing installation to make from the standpoint of efficiency, weight and how to best apply it, the installation is made in the airplane. Flight tests follow, under various conditions of cruising speed and engine power. A noise meter is used to test all parts of the cabin in flight.

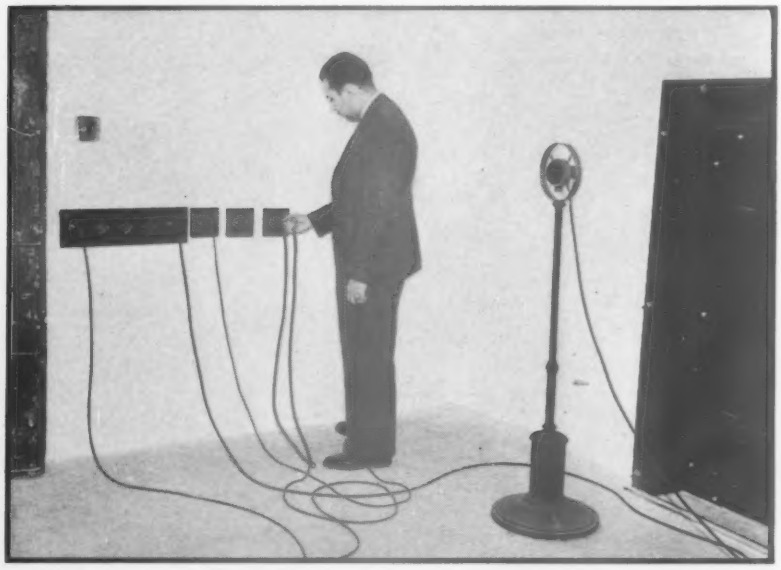
Now, more elaborate testing equipment and a continuous research program are necessary to insure proper soundproofing; problems are multiplying daily with the jump from two- to four-engined aircraft, the use of much larger power plants and the raising of cruising speeds. Furthermore, many types of new soundproofing materials are reaching the market and each must be tested to determine its merits.

A unit of sound study that has become familiar to the aviation industry in the past decade is the decibel. This unit is a measure of the logarithmic energy ratio that reaches the ear. A sound is a wave set up in the air, or other medium, by some force; it is the action of this wave on the ear drum that causes us to hear. A woman singing a lullaby uses little energy and produces a small wave resulting in a small sound. A hog caller uses a good deal of force, producing a large wave that shocks the ear at a short distance.

The average threshold of audibility for a 1,000-cycle note is used as a basis for measuring sound. This is called the zero decible noise loudness, corresponding to 10-16 watts per square centimeter. It ranges from there to the point of maximum human endurance at 120 decibels. However, it does not hold true that if we have twice as much sound energy, we get twice as much loudness or decibels. The ear isn't made that way. For instance: two

(*Continued on page* 94)

The control plug panel of the Boeing sound laboratory is in the "live" room shown below. The microphone is standing before the door that leads to the "dead" room.



Fortress FACTORY

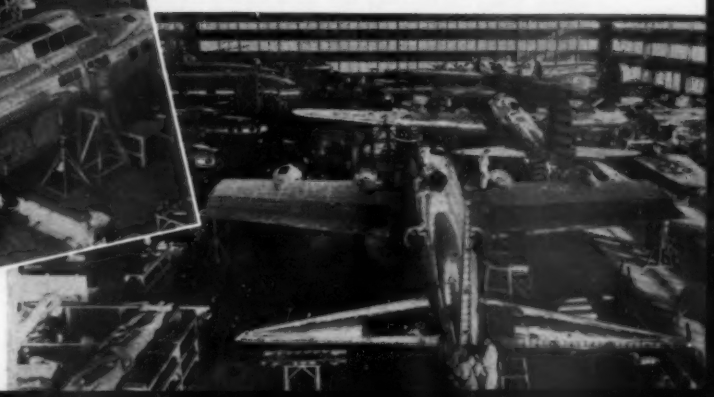
This finished wing panel leaves its jig to move to wing production for completion.

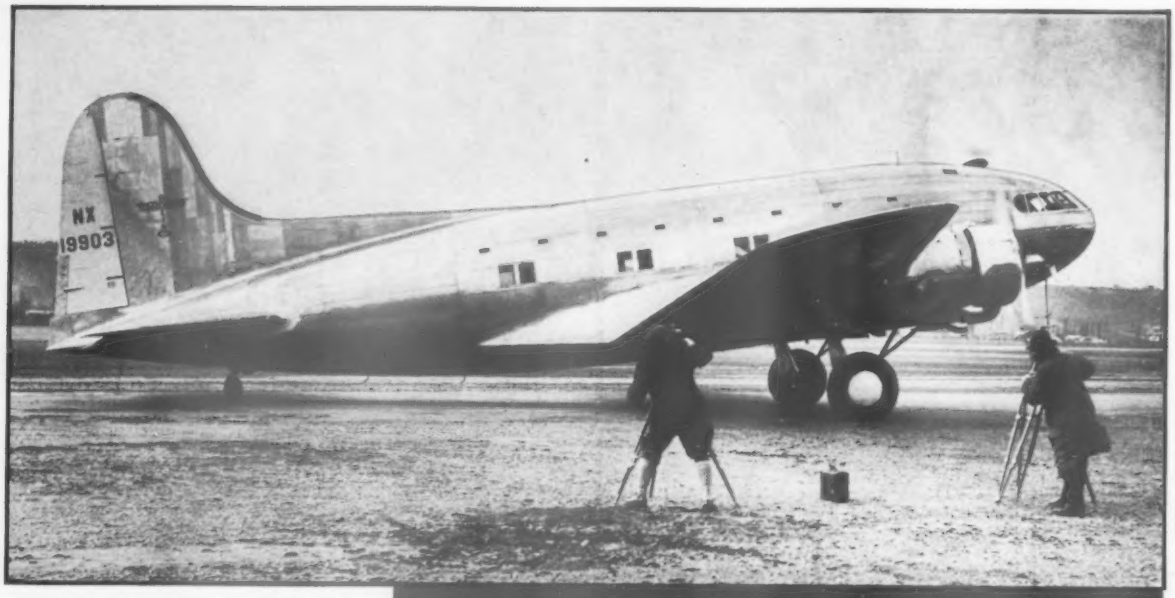
Completed wing sections travel down the production line to final assembly. Here wings are complete with landing gear and engine nacelles.

BOEING B-17B *Flying Fortresses*, the deadliest long-range bombers in the world, are being produced for the U.S. Army Air Corps at a rate of one every four working days. These 22-ton giants have proved so successful that Air Corps officials have placed several additional orders for *Flying Fortresses* since the original contract dated December 18, 1935. The photographs on this page show the latest batch of B-17B's on the Boeing production line. Though basically similar to the original B-17, the latest *Flying Fortresses* incorporate many new features. Chief among these are the more powerful and supercharged engines that have boosted the bombers' normal operating level up into the substratosphere. As can be seen in the accompanying pictures, production of these four-engined bombers has been set up on the order of automobile assembly lines. All sub-assemblies feed into the main production line which, in turn, feeds directly into final assembly. Normally, the *Flying Fortress* is powered with four 1,000 h.p. Wright *Cyclones* driving hydromatic propellers. The crew can consist of from seven to nine men: commanding officer, pilot, co-pilot, navigator, engineer, bomber, radio operator and gunners. For long missions, additional crew members are carried. Last order for B-17B's amounted to $8,102,892.

Fuselages leave their jigs and travel by overhead crane to meet the wings at start of final assembly.

Looking down final assembly, the B-17B's can be seen nearing completion. Test flights follow.





First Boeing "Stratoliners" are being delivered to Pan American for test work.

AIRCRAFT TO ORDER

by SPENCER GREGG

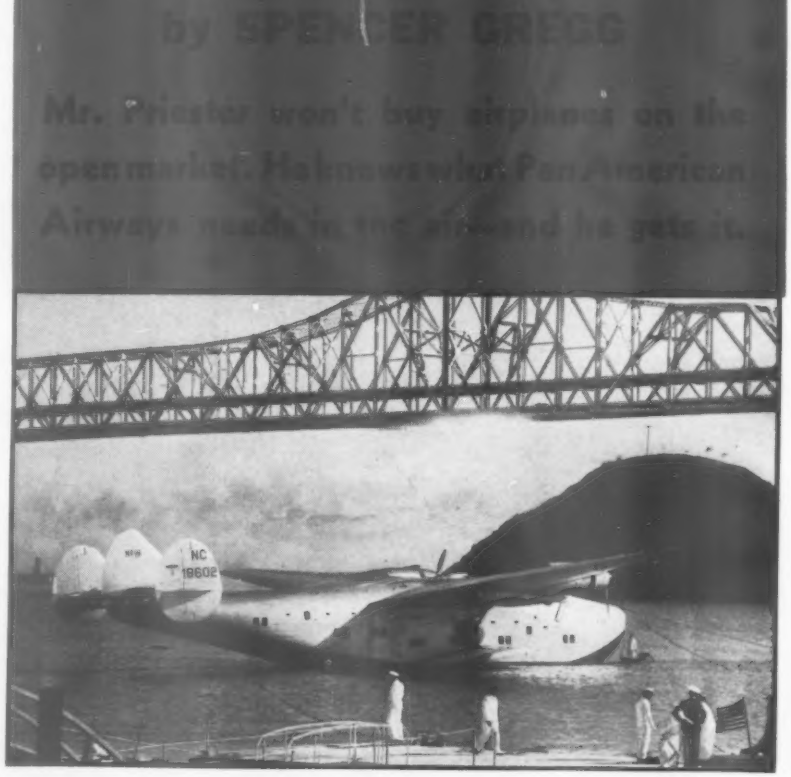
ANDRE A. PRIESTER is a stubborn little Dutchman who has been called the finest air transportation engineer in the world and those new airliners which presently will begin to fly the routes of Pan American Airways have been built, by golly, to meet Priester's demands.

Priester is man, symbol or legend, or a combination of the three. As chief engineer of a far-flung air transport empire he has, by sheer drive and stubbornness, obtained two new types of airplanes which incorporate certain characteristics he wants in his ideal long-range ship of the future. One is speed. The other is the ability to cruise at high altitude.

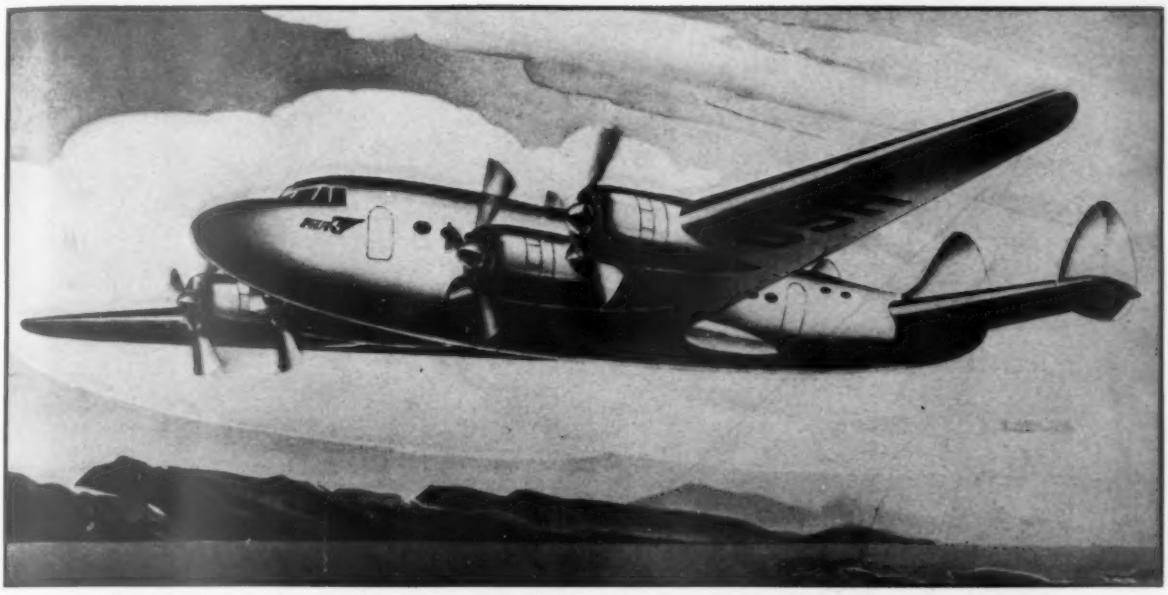
A third type, which Pan American only now has drawn the specifications on, promises to be a closer approach to the plane which the Dutchman, brooding in his aerie on the 59th floor of New York's Chrysler Building, has got in the back of his head.

This is going to be a story not so much on Pan American Airways' new planes as the reason for them and, before it proceeds, two foundation stones must be laid to explain why the company does things as it does. One is that it never goes into the market and buys a plane which might fit its purpose; it has planes built to fit its needs. The other is that no matter what kind or type of airplane the company acquires, Andre A. Priester will never be satisfied with it.

The super-super transport airplane—the flying wing which will carry 500 passengers at 600 m.p.h. 50,000 feet



The famed Boeing Clipper was designed and built to Pan American specifications.



Newest PAA project now being built is this Lockheed "44". It will be used with "Stratoliner" in tests. Meanwhile, plans are being completed for an even larger four-engined landplane to cruise at 265 m.p.h. with load to Hawaii.

above the good citizens of Peoria or Pretoria—has existed in the minds of the Sunday supplement writers ever since Lindbergh collected $25,000 for adding the name Ryan to the French vocabulary. A better transport plane built the hard way—by a gradual accretion of knowledge over a long period of years through the use of equipment which filled the bill in some measure—has been the progressive goal of Pan American ever since it began carting passengers over that 90 miles of water between Key West and Havana.

Still working toward the realization of that better plane Pan American let, or participated in, contracts for the construction of the new four-engined Lockheed and Boeing landplanes. It might be noted in passing that since 1927 exactly 21 advanced type transport aircraft have been designed and built in the United States—and 12 of them have been the exclusive projects of Pan American. Six others have been cooperative projects with the manufacturers or other airlines, or both. Only three have been built without the benefit of the company's engineering help—the Curtiss *Condor*, the Douglas DC-1 and the Boeing 247.

Panair's research on engines is part and parcel of the company's long-sought goal to eventually establish overnight air transport service between America and Europe, to bring Buenos Aires within 48 hours of Miami. Yet a better engine, taken by itself, scarcely tells the story of 300 m.p.h. speeds and cruising ranges of 5,000 miles which, Pan American makes clear in its conversations with the manufacturers, must be developed if the United States is to maintain its superiority over foreign competitors.

It was Priester who years ago began to make the lives of engine manufacturers miserable with his demands for added

Andre A. Priester

efficiency. He is a heckler by nature. It's the way he gets things done. He used to delight in heckling the late Anthony Fokker, the Dutch genius who was called the first man ever to make a million dollars in aviation. Employed by K. L. M., the Dutch airline, Priester was brought across the Atlantic in 1926 to run the 1926 "model" airline between Philadelphia and Washington for the Sesqui-Centennial Exposition.

Incidentally, Ed Musick, one of Panair's immortals, was a pilot on that airline. Fokker set up a factory in New Jersey about that time and Priester went to work for him. In the same year Juan Terry Trippe, who was to become the guiding star of Panair's transportation empire, hired Fokker to fly one of his F-7's to Havana for a survey of the route. Priester went along. When the plane got back to Miami, Priester was on the Trippe payroll.

Then and there he wheeled on Fokker with demands for a better airplane. When Priester began badgering the engine people for better power plants years ago, they were working on the theory that perfection lay in getting the most power out of a pound of weight. Priester rapped his knuckles on the conference table. That wasn't what he wanted. Weight be damned, he must have a lower fuel consumption per horsepower-hour. He argued that the critical aspect of long range flying was fuel consumption. The engine companies demurred.

It is of record now that Priester won his point. One of the larger manufacturers actually is building an engine for Pan American which is 500 pounds heavier for a given amount of horsepower than a counterpart which is being sold to other airlines on a weight-horsepower basis. But—and this is the telling point—with the added weight, permitting sturdier construction, finer adjustment and better combustion, the fuel consumption will be reduced from .40 of a pound of fuel per horsepower-hour to .38.

What does that add up to? Just this: for every tenth of a point that consumption is pushed down, there is a saving of 40 pounds of fuel every hour. In 12½ hours of ocean flying, the 500 extra pounds in that engine will be absorbed. That, of course, adds up to more payload.

Behind the construction of the new Boeing and the new Lockheed are those general goals so often pictured by Pan American's President Trippe:

(*Continued on page* 80)

New York's new airport probably is the most expensive of its kind on earth. With much of it reclaimed from under water, the field so far has cost some $40,000,000.

The WAIL OF TWO CITIES

by EDWARD FISHER

A war of words has been raging back and forth across the Hudson River for months. New York and Newark each believes its airport is the best.

CONCEIVED of Fiorello H. LaGuardia and sired by the Federal Government, North Beach airport was brought into the world with $40,000,000 WPA labor pains. But though the birth of North Beach meant victory for New York in its decade-long struggle for an airline terminal, it was only the denouement in a bitter toe-to-toe fight carried out in metropolitan newspapers between New York's mayor and Meyer Ellenstein, Newark's chief executive.

This classic battle, which dwindles European border feuds into the category of chess matches, has been waged with constantly increasing fury until it has embroiled considerable masses of population on both sides of the Hudson river. Like two lovers fighting for the hand of a dignified lady, LaGuardia and Ellenstein have used every trick at hand to favor himself over the other in the lady's eyes, while each insisted he would be the better provider. She—the collective airlines which operate into the metropolitan district—has favored first one suitor, then the other. And although her final choice has been LaGuardia, she does all possible to keep Ellenstein on the hook.

The cost to the airlines for the use of LaGuardia field is steep and the lines are suffering from an attack of the "I told you so's" from Ellenstein, who has threatened them with expulsion altogether from the Newark field. This would not be palatable to American Airlines, United Airlines or Transcontinental and Western Air, who realize that the suburbs and industries in northern New Jersey mean juicy business to them. They're banking on the hope that Ellenstein is so unsettled from the loss of his pets that he is spouting off with anger and will eventually regain

his good humor toward them. Meanwhile LaGuardia makes frequent trips to North Beach to gloat over his most enduring accomplishment.

Ellenstein has threatened to consult his law department to ascertain whether the airlines are meeting the provision of the C. A. A. which requires that they continue to serve Newark with "adequate schedules", and has appealed to the circuit court to reverse the C. A. A.'s decision appointing North Beach and Newark co-terminals for greater New York. Newark's congressman has requested a congressional investigation of the C. A. A. on the grounds that they had come to their decision against Newark before the case was reviewed.

The Little Flower stands pat on the statement he made when he opened the new airport October 15: "We are not in competition with any other airport around here. Let them first go and build an airport and then, perhaps, we'll have some competition."

The North Beach versus Newark feud goes farther back even than North Beach. It reaches into the first years of the last decade when LaGuardia had thrice been given hearings by the Post Office Department to have Floyd Bennett airport made the eastern terminus for the air mail, and had been turned down because of the inaccessibility of the municipal airport to Manhattan.

Newark, contesting LaGuardia, had learned as a result of the hearings that their field was favored because its location saved an hour's handling when flights canceled. Being 15 minutes out of New York City on the main line of the Pennsylvania Railroad and being a center for four other roads, Newark is favorably located as a forwarding point for trained mail. Their post office is some three miles from the field office and it is a matter of minutes to truck mail from the field to town. Whereas, any airport in New York would necessarily be miles further from the General Post Office and the railroad terminals. It was for this reason the post office decided against terminating air mail at Floyd Bennett and, incidentally, made Newark conscious of the fact it had a powerful arguing point against further attempts to lure the airlines across the Hudson.

In view of those facts, the news that New York City was acquiring the old Glenn Curtiss airport at North Beach in the borough of Queens rated only a stick of print in the Newark *Evening News* of January 3, 1934. In fact, agents of Ellenstein, investigating a few months later the airport leased by LaGuardia, reported it as "no threat" to Newark because it was only 138 acres in area and had water on two sides. Besides, they added, even after the Tri-Borough bridge was completed the airport would be no closer in running time than Newark to the General Post Office in New York.

Their opinion seemed justified for, during the next three years and a half, little was done about the new airport which had come to be known as "North Beach." LaGuardia encountered a flood of trouble in his plans to promote the little field into the world's leading airport. He had to buck the objections of Controller John D. Sullivan, the Board of Estimate, the Sinking Fund Commission and the War Department. He was contested in court by Clarence Chamberlain who believed the Holmes Airport, with which he was connected, should have been chosen instead of Glenn Curtiss field. Then the mayor had to get approval of President Roosevelt for $9,000,000 in WPA funds.

But the mayor has a mind of his own. He announced on August 15, 1937, that he was going to develop North Beach into a first-rate terminus for land and seaplanes at a cost of $12,762,500 and spread the work over a period of two years. Ten days later the Board of Estimate approved the purchase of the airport, which had been under lease to the city, for $1,300,000. Newark was more annoyed than worried. After all, the post office was on their side and the post office controlled the airlines.

Next month, somebody asked LaGuardia how North Beach would compare with Newark as the mayor was dip-

Newark's swamp-bordered airport served the airlines from their infancy. The move to North Beach was blamed largely on Newark officials' disinterest in requested improvements of facilities.

North Beach offered the airlines much in the way of facilities. These ultra-modern hangars were an important part of the lure that drew the major lines from Newark. American Airlines led the way.

ping the first bucket of dirt from a hill that had to be leveled on the field. "As Kirsten Flagstad is to Gipsy Rose Lee," said the old Wagner lover.

This was a barb that hurt Newark, where a huge hangar was being constructed with WPA money and plans were afoot to improve the runways. A large administration building was just being finished with taxpayers' money and the citizens were proud of their field.

Employees at the airport, however, knew the airlines were annoyed with the city government because of the delay in completing the hangar and negotiating leases for use of it. They were housed in small, ill-equipped hangars and were anxious to move into the $2,000,000 structure just building. But a delay in Government appropriations for the WPA had prevented Ellenstein from promising an opening date on the hangar.

By the first of 1938, the price of North Beach had gone up to $14,292,500 and Newark was beginning to think up reasons why the airlines would never go over to New York. There were five most commonly heard: 1. Newark was more accessible to New York's main post office and the North Jersey urban area as well as lower Manhattan; 2. Low cost of connecting rail service; 3. Availability of railroads for substitute service in bad weather; 4. Buildings and gas tank obstructions over New York; 5. Added mail handling expense from North Beach.

Summer of the same year found the price of North Beach jacked up to $23,000,000 and "possibly more." Ellenstein was aroused, as it appeared the airlines were seriously considering a move to New York. The press printed such stories as this taken from the Newark *Evening News*, July 13, 1938: "CONDEMN NORTH BEACH: Aeronautical Safety Experts Call LaGuardia Airport Menace To Flying."

Ellenstein became really alarmed when, on July 26, 1938, LaGuardia had nine technical experts from the airlines fly over his airport and gather together to speak about the safety measures and conveniences their lines would require. By this meeting the airlines signified their intention to use North Beach if it conformed to their needs. In high state of nerves, Ellenstein requested—on the same day—that the airline officials meet later in the week to discuss Newark hangar rentals and their policies in regard to the old field.

But he was too late. It was this point—hangar rentals—that the lines had wanted to clear up long ago. They had wanted to sign 10-year leases for hangar space at Newark, but had found the city unwilling until North Beach had become a substantial reality. It was the airlines' turn to hedge. Since that day, the Big Three airlines have grappled with a delicate diplomatic problem: to convince Newark that while they were moving their bases of operations to North Beach, adequate service would be given the old home town.

The airlines were by no means acting as a unit in respect to the transfer. American had from the very beginning been pulling with LaGuardia. So while they prepared happily to move into LaGuardia's domain, United and TWA followed reluctantly because the competition would demand it, but with misgivings. Capt. Eddie Rickenbacker, president of Eastern Air Lines, disapproved entirely of the move as an extravagant gesture and said plainly he was staying at Newark. He nevertheless put in a last-minute application for permission to operate out of North Beach with the other lines and did not move until competition forced him to, months after the other lines. At the time of writing, he still plans to keep his base at Newark and operate about half of Eastern's flights from the New York port. Canadian Colonial Airways, which operates only between New York and Montreal, had temporary quarters at Newark and moved to North Beach as a matter of course.

Original plans had called for the concurrent opening of North Beach and the World's Fair. But as Flushing Bay claimed more and more of the fill that was used to build up the New York airport and as the hangars and administration buildings had to be built on piles because of the soft ground, 24 hours became too few in a day to keep up the construction schedule. The original $12,000,000 estimate of the cost rose steadily to $40,000,000 and more.

Newark took hope. There were stories that the sinking of the filler material and the action of the water would delay the port for years. There were stories that the World's Fair Trylon would be too close to the port and would cause its condemnation until after the Fair. But always, Newark lived in the belief that the Post Office Department would prevent the move. It was their last ditch argument.

(*Continued on page 97*)

After many delays, Newark finally finished its new hangar intended for the airlines. Now, however, it has been leased to the Brewster company for use as a plane factory.

I Learned About FLYING From That! - No. 13

by Capt. Earl H. Robinson

SKY high is 1,700 feet.

You've heard the expression "blown sky high" in an explosion?

I was—and that's how I know that "sky high" is exactly 1,700 feet, straight up. In more than 4,000 hours of military flying, test piloting and movie air stunts this one split-second brush with death drove home to me a lesson in aviation that no man or woman who flies should ever forget:

You are only as good as the man on the ground.

I'd like to elaborate on this a bit. In military flying the pilot succeeds in his mission only if the ground crews have made certain that his plane, guns and equipment are perfection; and if headquarters tacticians have mapped out a mission that *can* succeed. In test piloting, the flyer's life is forfeit to the skill of designers and the craftsmanship of the men who built the plane. In airline flying, of course, each plane is literally the apex of a pyramid of ground crews, weather observers and radio traffic control men from whom the pilot takes his orders.

In no branch of aviation is this unwritten law more inflexible than in movie stunt flying. When we take off to perform a stunt that will leave the audience gasping, we leave our lives behind us in the hands of the ground crews. The penalty for a mistake is . . . well, there are only 12 of us left.

During the filming of "Dawn Patrol" in 1930, starring Richard Barthelmess and Douglas Fairbanks, Jr., there was a sequence in which the two heroes bombed a German airdrome and machine-gunned the ground personnel. If you didn't see the original picture the 1939 issue of the film, starring Errol Flynn and David Niven, contains the same scenes. (Warner Bros. saved the expense of filming the dangerous flying sequences by lifting them bodily from the 1930 version.)

Leo Nomis (who was killed a year later during the filming of "Sky Bride" for Paramount) and I did the flying in the airdrome raid. To understand our task, you should know how the scene was made. A "location" airport complete with hangars, shops and officers' quarters, was built in a valley about 30 miles from Hollywood. On the field were several Jennies and other old planes painted with German insignia. Each was loaded with a charge of high explosive. Additional charges were planted on the field, in the buildings and at other points. Wires led from each charge to a button on a "powder table" out of camera range. Stationed at the table was a "powder man," supposedly an expert at placing the charges for the best pictorial effect and also supposedly a cool-headed technician who would set off the proper blasts a split-second after Nomis and I passed over a given point

(*Continued on page 75*)

Here is a pilot who did an almost literal job of going up in smoke.

Plane in the air is author's. Picture was snapped just as blast was set off.

GROCERY BOMBERS

Government's Stinson "bomber" has trapdoor (bottom of page).

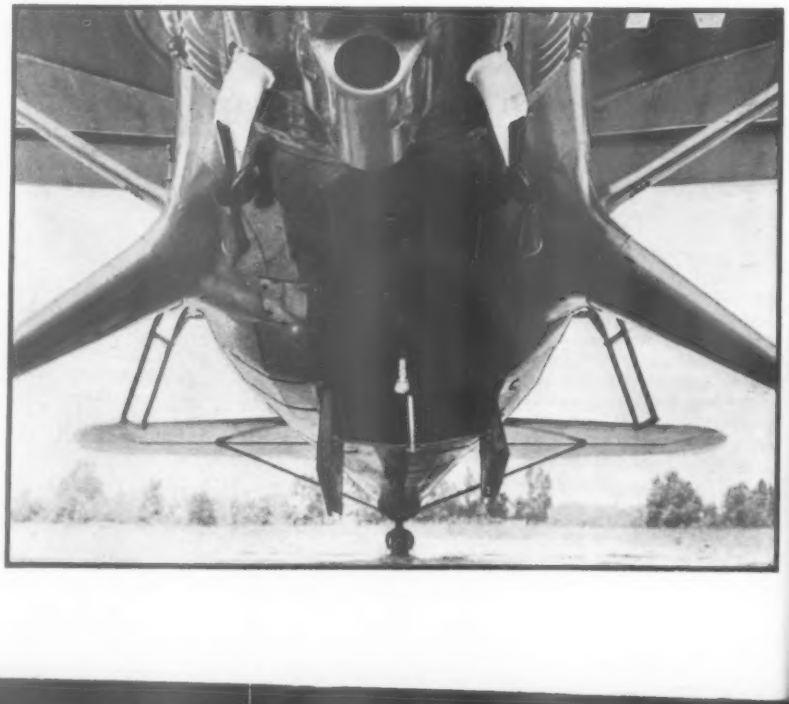
by O. A. FITZGERALD

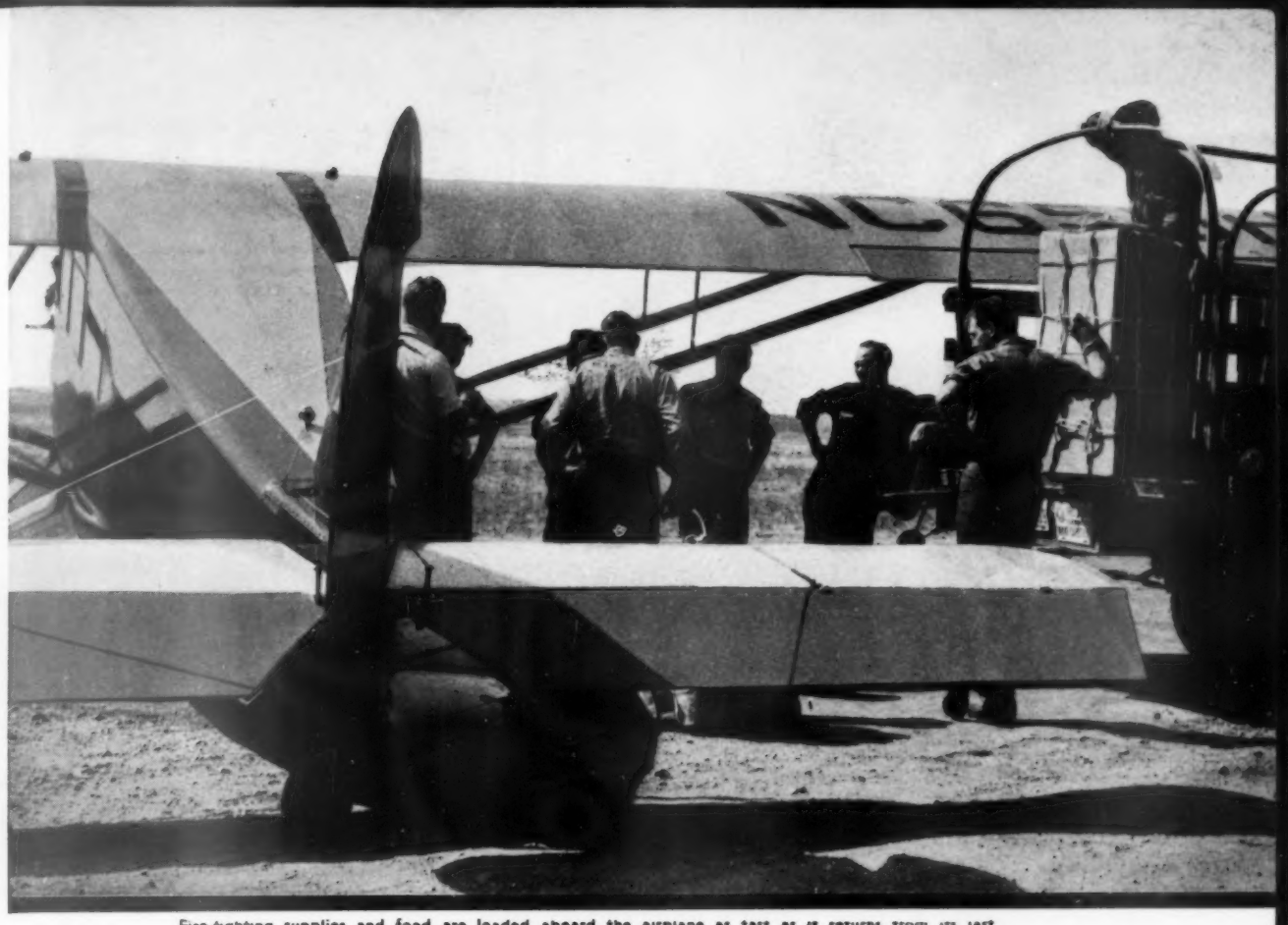
These American airmen are engaging in a form of bombing in which everyone approves: dropping supplies to forest-fire fighters.

"EVERY one right at their kitchen door," smiled the pilot with pride as he stepped from the open doorway of his silver monoplane at the McCall, Ida., landing field. What he referred to was five big packages of food and supplies he had bombed on one of three U. S. Forest Service camps about 75 airline miles back in the mountains where 600 fire fighters, with seemingly insatiable appetites, were busy corralling a blaze which had manifest powerful determination to turn coal black a big sector of Idaho's "primitive area." One look down from a grocery bomber provides reason enough why this land has been left primitive and why foresters and others whose work is in the mountains are taking to sky trails.

For three days skilled mountain flyers had been doing this welcome kind of bombing over as rugged and cut-up a land as you will find anywhere in a state which likes to think of itself as the "Switzerland of America." No anti-aircraft guns, no air raid alarms sounded when these bombers swept over their objectives. They were welcome because they brought food, tons of it.

While the ground crew put 40 gallons of gas in the ship for another flight and moved the supply truck so part of its load could be transferred to the box-car-like cabin, the pilot walked over to talk with Forest Service officials on how the fire appeared to him from the air. As





Fire-fighting supplies and food are loaded aboard the airplane as fast as it returns from its last trip. Some planes have carried as much as 4,000 pounds of supplies per load into mountain camps.

they talked, five big packages, each consisting of several cases or boxes tightly lashed together with light rope, went into the ship. To each package was fastened a discarded Army parachute to ease the ride to the earth. The total load amounted to about 1,000 pounds. Some of the larger ships will carry loads of 3,000 to 4,000 pounds to isolated mountain camps.

The "dropper," whose job it is to kick the package out the doorway, from which the door has been removed, climbed in with the load of grocery bombs. The pilot waved to the ground crew, which settled down to rest until the next plane came in, and "gave her the gun." Three-quarters of an hour later a white "X" on the ground, identifying a spot officially known as Camp 1, came into view. Dipping to about 300 feet above the camp the pilot signaled and the dropper, fastened to the inside of the ship with a safety belt so he couldn't go out with the groceries or be flipped out when the ship hit an air pocket, gave two cases of fruit a determined shove. Down shot the package, snapping the chute out behind it. With a terrific pop the big sheet opened up and eased the ride to the ground. Swinging around in a huge figure 8, the pilot gave the kick-out signal at each crossing over the camp. Out went two bulky cartons of bread, a quarter of beef and boxes and cartons of other foods. Fifteen minutes later he was heading back to McCall for another load.

Bombing everything fire fighters need marks one of the biggest advances in man's persistent search for ways to speed up the attack against fires which break out every year in our hundreds of millions of acres of western forests, often in the most annoyingly remote places. So long as we have lightning storms and careless campers and smokers we will have forest fires. Since we can hardly hope to control lightning—neither is the prospect of controlling careless individuals any brighter—the greatest opportunity lies in speeding up control so that more fires are, to resort to a badly worn but highly appropriate expression, "nipped in the bud."

Even with the best in mountain roads, trucks hauling men and supplies across canyons and rugged divides seldom average more than 20 m.p h. Horses carrying men and supplies travel three to five m.p.h. over mountain trails. Men hiking on these trails make two to three m.p.h. Cutting cross-country, often necessary to reach a fire, is at the rate of only one or two m.p.h. These canyons and rugged hillsides which slow down ground travel mean nothing to the grocery bombers that come in over the sky trails.

Costs of packing supplies by mule trains over good trails are comparable to plane delivery costs. Bulky items, such as lumber, stoves, water pipes and other heavy equipment needed by forest crews, are delivered much more economically by air. Even if the plane did cost more it would be worth it, for speed is the most important factor in forest fire fighting. Often the difference of a few hours in starting the attack on a fire means the difference between squelching it at little expense and spending far more when it develops a devastating front of many miles.

To see exactly how the airplane brings this all-important speed let's have a close-up of the Big Creek fire, to which the grocery bombers were flying out of McCall. It was Tuesday afternoon, August 15, when frantic calls for help came to Supervisor Henry M. Shank of the Idaho National Forest from lookouts scanning the Big Creek area. During the first afternoon an ambitious fire had mushroomed over 2,000 acres.

Before the day of airplane fire fighting the attack would have developed like this: when the lookout called for help a truckload of men would have started from McCall. Now there is no use sending fighters unless they have shovels, saws, picks, axes and other implements and, more important perhaps, bedrolls and food. So the second and third trucks would have hauled supplies. At the end of the road, still 24 miles from the fire, each man would have taken his sleeping bag and light rations and hiked the rest of the way while the trucks started back

Flights of supplies sometimes are arranged by meals. One flight will take in a load of breakfasts, another will haul hundreds of lunches, then a ton or more of dinners.

for another load Pack-trains would have been assembled to haul supplies from the road end to camps on the fire line. At least three days would have passed before complete and fully equipped crews were on the fire and during these three days the men would have been drawing pay without doing very much toward controlling the fire. It happened that way in 1931 at a fire in approximately the same country. Three days passed before control got under way at top speed.

Now here is how planes changed the picture: when Supervisor Shank put in a call for four ships, that removed from his mind the huge problem of grub and equipment. All the trucks that could be commandeered, therefore, were available to move men. By daylight the next morning 450 CCC boys and fire fighters recruited in the McCall region were ready to show that upstart blaze who was the boss. By the second morning 600 men were on the fire line. Of course the men still had to walk those 24 miles from the end of the road but they had nothing to carry and knew equipment would be falling from the skies by the time they got there.

As the trucks moved men, another branch of the forest protection machinery was hitting top speed. The supply warehouse crew carted sleeping bags, hundreds of them, bundles of axes, saws, shovels, etc., to the flying field at McCall. The first flights took in short-wave radio sets and operators and fire-fighting experts to organize the attack. Even delicate things like radio sets are sometimes kicked out in mid-air—specially packed of course. But in this instance the planes put down at a mountain meadow about three miles from the fire.

After moving in the sleeping bags (dropped in bundles of four without chutes) and the fire fighting tools, the planes then tackled the bigger job of keeping 600 appetities satisfied, an assignment involving the bombing of about nine tons of groceries and other supplies daily. In less than an hour planes reached camps which could not have been reached in less than 18 to 24 hours of continuous travel over road and pack trail.

When I talked with Supervisor Shank the following Saturday morning the fire was under control, men were being brought out and some of the grocery bombers were returning to their home fields. The blaze had been stopped with a total burn of only 2,675 acres. Only mop-up and protection crews remained. Without planes there is not the slightest doubt but that this fire would have developed into one of tremendous proportions.

What do they bomb on the forests? Everything, it appears but the fighters themselves. Some day they may even do that. The Forest Service has been experimenting in the state of Washington in parachuting men encased in a protective suiting which will soften the landing should they come down on a hillside more suited to mountain goat than to man. Upon landing, according to the present theory, the men will crawl out of the suit and be off to fight the fire.

One can imagine how sky-minded foresters have reacted to pictures showing the air filled with Russian soldiers parachuting from planes. Dropping fire fighters may work in some places but among the men who fly the grocery bombers over the rugged western mountains there is no enthusiasm for this new idea. There is no urge among them to jump out, no matter what kind of protective suit may be developed. Look down from one of the grocery bombers on its flight from McCall to Big Creek and you will know why.

Bombers drop water pumps, trench digging machines and all kinds of fire fighting tools as well as packages of food. Breakage, even with cases of eggs, which receive no consideration other than the parachute, is of no consequence. Occasionally a chute is slow to open and the load gets a good flattening, particularly if the plane is flying low. On one flight out of McCall the tip of a chute carrying a quarter of beef caught on the hook of a safety belt inside the cabin. Frantically the dropper tried to tug it loose. When he did the plane was on the opposite side of the ridge from camp. Bears and coyotes got an unexpected feed of prime beef. Except for such rare instances the loss is of no significance when compared to the new speed planes have brought to fire fighting.

Most of the bombing is done on regular base camps. Some of the food is organized at the supply warehouse on a meal basis, usually for units of 25 men each. One flight will take a load of breakfasts Another will haul several hundred lunches and the next a half ton or so of dinners. The mid-day lunches often are dropped where the men are working along the fire lines. To the flyers it makes no difference whether the men are in the valleys or on the hillsides. All they ask is "Where do you want it?" If the fighters are in a dry camp or on a mountain side where water isn't handy the planes will bomb cans of iced drinking water on them.

On the average about five per cent of the chutes never come out again for another trip. Landing in trees or on rocky hillsides, they are torn so badly they are rejected even by the grocery bombers, who previously were satisfied with nothing more than a big hunk of burlap as a chute. When the bombing is done at camps in heavy timber the parachute loss may be heavier. After a few days flying the trees around camp look like someone has hung out a washing.

These grocery bombers are accurate. Draw a 100-foot circle in white on the ground so the pilot can see it and experienced mountain flyers will consistently bomb the big packages within it. No city delivery truck ever gave a customer better service than one pilot performed for the cooks at Camp 3 on the Big Creek fire. He dropped a chute carrying two crates of eggs on a tree right beside their field stoves. When the package came to rest the eggs were swinging about four feet from the ground. All the cooks had to do was walk a few feet, pry off the crate lids and take out the eggs as they needed them.

Cooks appreciate this accuracy in placing the packages right at the edge of camp. But sometimes the pilots are too accurate. Then you should see cooks and helpers leaving camp in a hurry. Grocery bombers are supposed to be accurate in delivery but they definitely are not to see how many direct hits they can score on field kitchens. Last winter one mountain flyer put a bundle—accidentally, of course—through the roof of a cabin where a ranger was staying all winter studying game in its winter quarters. "I appreciate the grub, I needed it, but I don't like the idea of having to patch up the roof at this time of the year," in his next conversation with headquarters.

Sky forestry has been growing amazingly since the first airplanes were used in forest fire protection in 1919. During the last several years planes have helped

(*Continued on page 72*)

Look Again, PILOT!

Airport runways from the air may take on many appearances, depending upon their type of construction.

by M. H. CARRINGTON

Pilots aren't always seeing what they think they are seeing. Here are a few well-chosen examples.

THE field truck was towing the light cabin job off the airport—towing it off tail first and tail high on the rear of the truck, because the tail in question had a mashed up wheel and slightly crumpled rudder bottom. Most of us had seen the pilot when he brought it in intact. We saw the way he landed. Only a few of the more experienced of us knew why he landed that way: 10 feet too high, then squashed down. Only the excellent design and construction of the plane saved it from serious damage. Only the inexperience of the pilot in such a situation as he had encountered was to blame. He was one of those fellows who always claimed you shouldn't believe anything you hear and only half of what you see. In this case he was dead wrong. By keeping his ears open around the hangar he would have heard about how a black tarred runway looks on a hot afternoon when you're landing from east to west. It looks about 10 feet higher than it really is, which accounted for the damaged tail.

Then, too, the pilot had plenty hours in the air to his credit but, as one greasemonkey put it, so did the water tank at the airport. The pilot had flown all over Kansas, Florida, Long Island and California but most of the time within sight of the field, with his night flying time put in on bright moonlight nights. Cross-country trips were from one end of San Joaquin Valley to the other—and then only when he heard "visibility ten miles or more" on his radio. As far as hours of flying, the pilot rated high; as far as flying *experience* went, he was way below par.

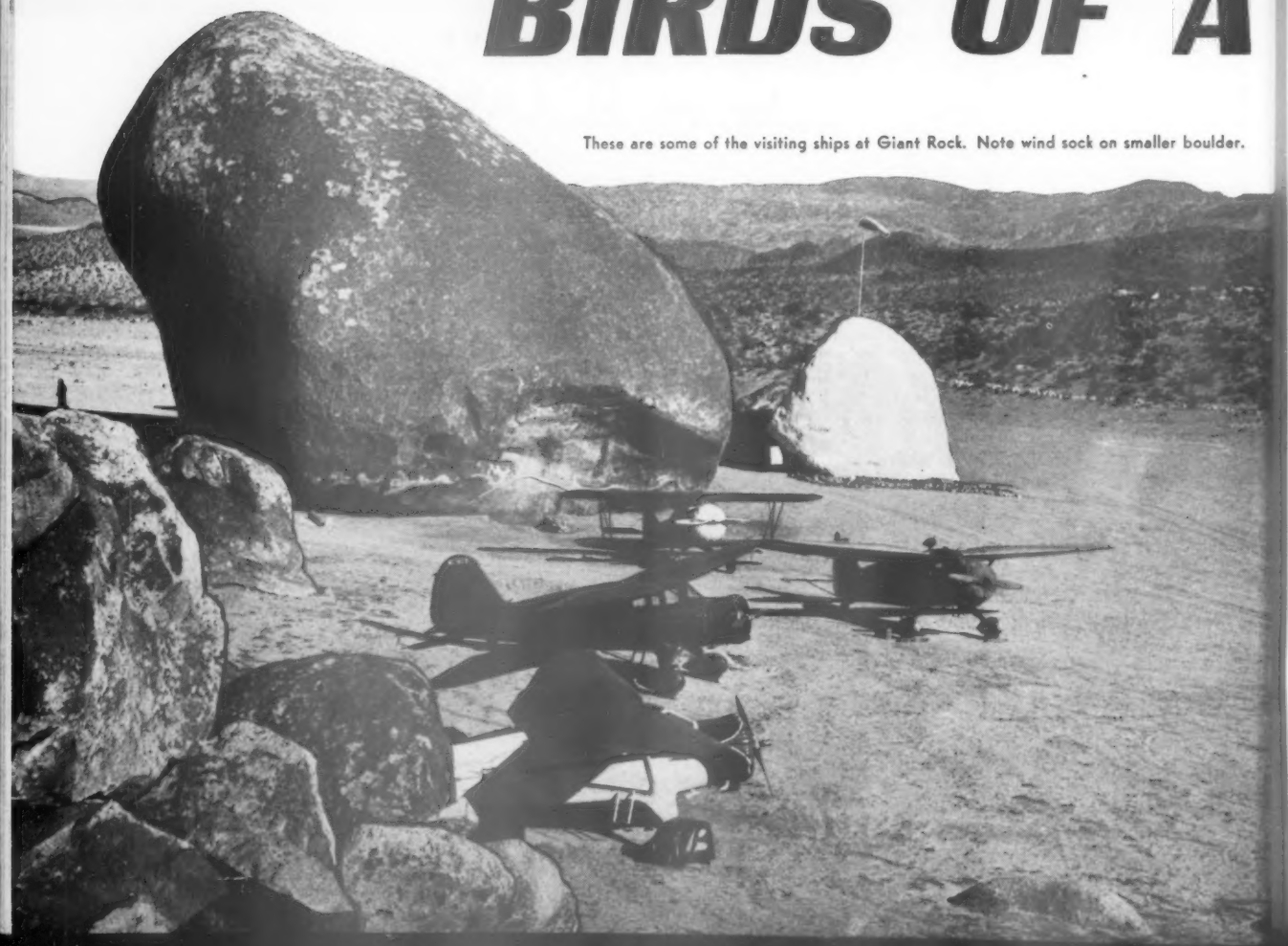
The mirage which fooled Pilot No. 1 would have gotten another one the week before, except that Pilot No. 2 had been high tailing it just over the tree tops *with* the wind for 100 miles before he had come in to land. Under those con-

(*Continued on page* 93)

Pilots must always look over strange airports carefully, alert to important details.

This Aviation Country Club group poses for its picture at Giant Rock, a favorite visiting place.

BIRDS OF A



These are some of the visiting ships at Giant Rock. Note wind sock on smaller boulder.

Architect C. S. Lee shows Grace Hutchinson his spot-landing booby prize.

by EDWARD CHURCHILL

A happy-go-lucky group of Californians have pooled their leisure time and their airplanes into the fun-lovingest gang of private flyers in the state.

FEATHER..

IN FEBRUARY of this year 40 airplanes winged from Los Angeles to Phoenix. No, the Army wasn't giving a demonstration. It wasn't one of those "on to so-and-so" junkets of mammoth proportions. It was just a group of nice people banded together by their love of flying taking a week-end jaunt.

Included in the group were three Lockheed "12's" (to mention the biggest) and a couple of Luscombe "65's" to cover the other side of the picture. At the controls were motion picture players, judges, oil company executives, a millionaire automobile racer, a walnut grower, a rancher and a Pasadena socialite. They all not only had that love of flying in common, but they belonged—and do belong—to the four-year-old Aviation Country Club, a southern California organization which boasts, among other things, of 1,250,000 miles of flying, 50 cross-country journeys and a perfect safety record. You join for $10 and thereafter belong to the democratic group gradually becoming famous in southern California aviation. You'll be welcome if you fly anything from the lightest of light airplanes to a multi-motored transport.

The February jaunt, one of the "big four" staged each year, was highly successful. Throughout Saturday the planes, large and small, fast and slow, took off from various points in the southwest and flew to the airport at Phoenix. Lee Moore, Phoenix business man and flying enthusiast, was official host. A pilot for years and at present the owner of a sleek Cessna, Moore took the arrivals to his ranch and gave them a barbecue. There was hangar talk and horseplay, after which the sleepy flyers turned in at the Westward Ho Hotel. After breakfast they did as they wished, and in the afternoon attended the annual rodeo. Some took off for their home ports as the shadows lengthened Sunday afternoon, while others remained to enjoy themselves until Monday morning.

In accordance with custom, there will be in 1940 the annual dinner at a Los Angeles Hotel at which all members will be free to make suggestions for the ensuing year. Just about this time there will be balloting to choose a board of directors and the board will name the officers. Also during the year there will be a jaunt to Del Monte, a shore resort near San Francisco, and two other trips are on schedule. One may be to Furnace Creek Inn in Death Valley and another to Sonora, Cal., both favorites with the membership.

The Aviation Country Club, loosely knit in structure and held together by friendship and common interests rather than by-laws, isn't listed in the telephone book. There isn't any club house, unless

A day of flying is good for the appetite. Below are Karena Shields and B. Rey Schauer, California superior court judge. He flies a Fairchild.

Horseplay for the photographer's benefit is supplied by Manufacturer Wally Timm (left) and Frank Belcher.

you want to give that title to the office of the secretary, O. D. McKenzie, head of the Curtiss-Wright school at Grand Central Air Terminal, Glendale. He'd object, because it is just a small office, not big enough for 155 members, 120 of whom are active. And 72 airplanes would clutter up the hall outside to some extent.

The organization started in 1936, mostly by its own momentum. It seems that every now and then an oddly assorted group of private flyers, ranging from Wallace Beery of the movies to Joel Thorne, millionaire owner and driver of everything from motorcycles and racing cars to a Lockheed "12", and from Capt. Claude Morgan of the Sheriff's Aero Squadron to Allan Barrie, vice-president of Western Air Express, would stand around the hangars at Grand Central trying to figure out where to go of a Sunday afternoon. One day

"Get a gang together and you build self-confidence. You pool knowledge and experience and you branch out. That's exactly what happened. We set ourselves a series of goals and flew to them.

"We were congenial. Everybody liked everybody else. And we started to find out that as an organization we got a lot of ideas. For instance, when we decided to fly to a given spot and could offer reservations for at least a hundred people we got a flat rate and swell rooms at the best hotels. We were afforded fine transportation facilities.

"Oil and accessory companies from whom we made purchases began offering special prizes on flights for the solution of navigation problems. Never did we race from place to place, but we tried to go the shortest, safest, most direct routes and from this our contests were developed.

"That's the way it started, and that's

These Aviation Country Club members, left to right, are Club President and Mrs. Jerry Fairbanks, Wally Timm and Mrs. and Mr. Charles J. Correll ("Amos and Andy").

Wally Timm, veteran plane builder, sent out a call for 25 of these "hangar pilots".

"You fellows," he said in substance, "look as if you were just hanging around waiting to get lost. You don't know where to go in your airplanes or what to do when you get there. Now, we're going to organize and really step out."

The idea caught on like wildfire. Among the 25 were Jerry Fairbanks, head of Scientific Films (makers of "Popular Science" and "Unusual Occupations" short subjects), Ben McGlashan, owner and operator of Station KGFJ; Dudley Steele, head of Union Air Terminal, O. D. McKenzie and several others of note. They took a vote and Ben McGlashan was the first president. Fairbanks was vice-president.

This was in January. Inside of a month the organization was gaining members right and left. Why? Well, the present president is Fairbanks. Let him talk a while.

"First," he says, "a fellow with an airplane doesn't like to venture off alone much, especially if he hasn't tried his wings. He rather self-consciously flies around the airport a couple of times, dusts off his ship and goes home.

the way we're going now. We haven't any great dreams of a huge club house and an airport; of fancy affairs and expensive entertainments. We're out to fly and to do it right."

The Aviation Country Club has been doing it right. For, during those 50 flights, there have been a couple of forced landings due to gas shortages and members getting lost, a downwind take-off by a member who piled up in a wash and walked away unscathed—but nothing else untoward.

Secretary McKenzie has built up a unique service on behalf of the club. Each member is bound on his honor, so to speak, to report any discoveries of interesting trips. Said member, having taken off for individual exploration, returns to fill out a complete report. How many miles did he fly? What obstructions in terrain did he encounter? Where did he spend the night and what did it cost? Did he meet any helpful people and who were they? How big were the fields used, how long were the runways and were they smooth or bumpy? Where were they located? How did he get a taxi or other transportation into town?

"When we started in 1936 about the only place we flew was Palm Springs in the summer and San Diego in the winter," Fairbanks says. "Now, any member may call McKenzie and find out anything he wants to know about a contemplated excursion. We've uncovered everything from desert airports to low tide landing places along the Gulf of Mexico and from dude ranches to historical sites and fishing points in the High Sierras."

Some of the original $10 initiation fees still are in the treasury. There never has been an assessment of any kind. The only "tax"—one of those hidden, unseen affairs—lies in the hotel rates. The club gets the special rate, which is very low, and then tacks on 50 cents per head. This money is used for stationery and stamps to mail out notices of proposed activities and the ballots.

The first set of officers, headed by McGlashan, were in office from 1936 to 1938. The present set, in addition to Fairbanks, includes John Fulton, process cameraman in a motion picture studio and owner of a straight-wing Stinson, vice-president; McKenzie, secretary, and Norman Larson, of Pacific Aircraft Sales, treasurer. On the board of directors are Frank Belcher, president of the Los Angeles Bar Association, flying a "300" Travel Air; George Armistead, connected with the Charles S. Babb organization; Ray Acre, head of Air Associates; Judge B. Rey Schauer, who flies a *Ranger* Fairchild and is a superior court judge; Johnny Meyers, owner of a Waco and attorney for the Columbia Broadcasting System; McKenzie, Larson, Fulton and Fairbanks.

There are several women who are members and who fly their own planes, exclusive of the wives of flyers who are members. Among them are Yolanda Spirito, Pasadena socialite who flies a Travel Air; and Bessie Owen, Santa Barbara writer. Fairbanks tells of meeting Miss Owen at Havana, Cuba, some time ago.

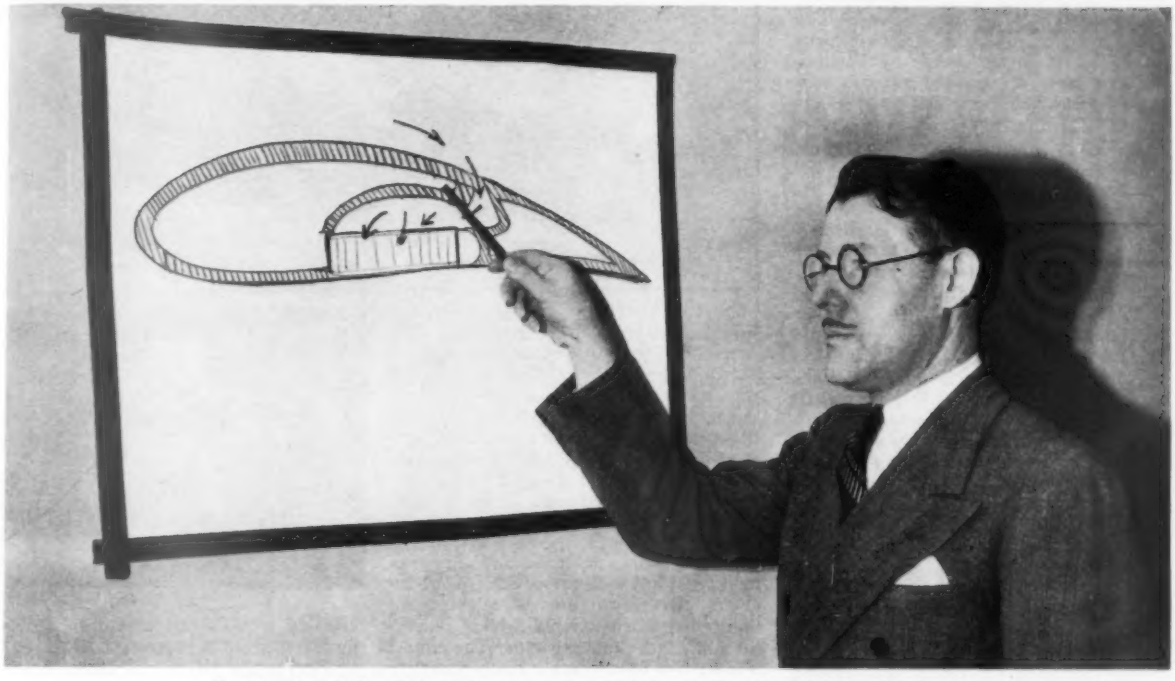
"I'd left my plane at Miami and had taken the boat across," he said. "In Havana I bumped into Bessie. She'd poured the coal to her Beechcraft in Miami and had crossed the channel. What was more, she was heading down to South America for a little air tour of her own."

The organization has become very large, but not unwieldy. Recently, the San Francisco group broke away and formed the Aviation Country Club of Northern California, with Larry Ames as president. This subsidiary, or outgrowth, has a membership of 40 and is operated on the same general principles as the southern California organization. On the Del Monte tour, the northern boys meet the southern group at that point and play hosts, more or less. Last fall—on November 11—the northern flight swung south over the TWA route and joined the Aviation Country Club in a get-together at Boulder, Nev., the town which came into being during the construction of Boulder Dam.

Douglas Kelly, of the Air-Tech Flying Service at Lindbergh Field, San

(*Continued on page 72*)

DR. STALKER HAS A CLUE



Dr. Edward A. Stalker illustrates his proposed method of controlling the airfoil boundary layer.

By JOHN C. A. WATKINS

Control of the boundary layer of air on the airplane wing has been an engineering puzzle for years. A University of Michigan scientist has a theory that may be revolutionary.

IN two American aircraft factories whose names cannot be divulged, two experimental pursuit planes which are said to resemble conventional fighters outwardly are rapidly taking form and soon—one day this year, perhaps not until next—will be ready for their first flights. When those two ships flash over the speed course on their preliminary trials, the presently accepted pursuit speeds of around 400 m.p.h. may jump overnight to unheard-of velocities. If they do, it means that the age-old problem (speaking in terms of aeronautics) of the control of the boundary layer of airplane wings will have been solved, a new era in aeronautics will open and the name of Dr. Edward A. Stalker will go down in aviation history with those of Wilbur and Orville Wright, Frank Caldwell and other Americans who have contributed so much to this form of transportation.

Early this year, at the annual meeting of the Institute of the Aeronautical Sciences in New York, Dr. Stalker stood in a hot, dusty lecture hall at the Columbia University and described to a "blue ribbon jury" of engineers, manufacturers and scientists how he and his colleagues in the department of aeronautical engineering at the University of Michigan believe they have discovered a method of boundary layer control. If they have succeeded in their quest, they have made one of the most important contributions in the history of aeronautics, for successful boundary layer control means a tremendous increase in aircraft efficiency. Putting it into lay terms, it means that commercial transports—or bombers, if that's what you want—can carry far greater loads at higher speed on less power and, consequently, at a reduced cost per mile. Sought for years by many of the great aeronautical research centers of the world, it is expected to result in pursuit planes flying faster than had ever been thought possible with conventional power plants of the presently accepted type. Applied to lightplanes, it will end the deadly spin and stall, thus eliminating at the source a good third of the fatal accidents in nonscheduled flying.

From the standpoint of the scientist engaged in pure research, the airplane wing, as it now is known, apparently is an inefficient mechanism, since most of its surface does no appreciable work. Practically no lift is exerted by that portion of the upper surface back of a point about one-third of the distance from the leading to the trailing edge. The stream of air flowing over the top of the wing leaves the airfoil at an angle at about that point and beyond that approximate position there lies an area of comparatively useless retarded or "dead" air which moves very slowly and which exerts no appreciable lift. Describing it in the terms of Dr. Stalker's paper explaining boundary layer control:

"There is about every body immersed in a moving fluid a thin layer of retarded particles called the boundary layer. To it can be charged more than one-half of the accidents in airplane operation, chiefly because the phenomena in this layer causes loss of lateral control. Underlying the control difficulty is frequently the desire to land at slow speed and, since this means at high lifting capacity, the difficulties of control and slow speed must be considered together. . . .

"If the boundary layer is at the basis of these accidents, upon it the attack should be concentrated. The cure for stalls and spins lies in controlling the boundary layer and, even if no other advantages accrued than that of adequate lateral control, the results would be worth all the cost. Actually, however, the airplane can be improved in most

every way by a proper governing of the layer."

The method Dr. Stalker has worked out to achieve these desirable reforms and which he has tested successfully in the wind tunnel, is to suck air from the under surface of the wing or elsewhere and blow it out over the rear two-thirds of the upper surface, virtually blasting the thin layer of retarded air into motion comparable to the speed of the airplane. Or, the retarded air may be sucked into the wing through slots located near the trailing edge, thus bringing the layer of fast moving air above the boundary layer continually down into proximity with the surface. The waste air can be blown out over the ailerons to increase their bite.

"From what has already been said about the phenomena," Dr. Stalker points out, "it is clear that when a fluid (meaning air, of course, in this case) is in contact with a surface, a boundary layer must form, and if this surface is curved to produce an adverse pressure gradient, separation will play an important role. The effect will appear as a mutual resistance to motion between the body and the fluid.

"In the case of wings, the control of the boundary layer will lead to astonishing changes in aircraft. If the lift coefficient is increased three times, the landing speed is reduced 42 per cent, so a present-day airplane landing at 50 m.p.h. will then land at 29 m.p.h. If the lift is increased six times, the landing speed is reduced to 20.5 m.p.h. If this is too low a landing speed—and I think a true still wind speed of 30-35 m.p.h. is low enough—the wing area may be reduced to increase the high speed. Also, more of the lifting capacity can be reserved for adequate lateral control. In air carriers, the added lift will be used in large part for increasing the payload and improving control."

Dr. Stalker pointed out that Handley Page discovered more than 20 years ago that a slot through a wing made possible an increase in lifting capacity of some 50 per cent, but he contends that the variations of the Handley Page slot now in use don't go far enough because:

"At best they only extend the range of angle some few degrees and it still is possible to drop a wing tip so rapidly that the motion carries through the safe range before the pilot is aware of it. If boundary layer did nothing but solve the lateral control and spin problem, it would justify itself in dozens of lives lost every year, even at the present time."

The Michigan scientist proposes the installation of a turbine in each wing, driving the airplane propeller through an over-running clutch with the propeller shaft extending rearward to drive the turbine in the airfoil. Wing slots provide for the induction and ejection of the air and a clutch is added to relieve the propeller of the drag of the dead engine when it is acting as a windmill. This would give a source of power independent of the engine "so that it will be available when the airplane lands, so

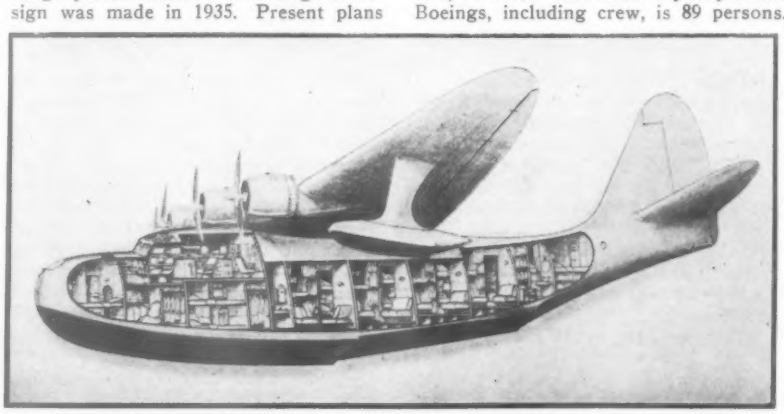
(*Continued on page* 95)

C. A. A. Buys "Cubs"

INSPECTORS attached to the Private Flying Development Division, the General Inspection Section and the Air Safety Board—all branches of the Civil Aeronautics Authority—already are covering the country in the fleet of new Piper *Cub Coupes,* some of which are shown above. The group in the above photograph are some of the 12 *Cub Coupes* recently delivered to the C. A. A.; that organization now is operating 21 of these ships. The C. A. A. ships are the most completely equipped airplanes ever to leave Piper's factory. Equipment includes two-way radio, complete blind flight instruments, wind-driven generator and a large fuel capacity. The engine is a 65 h.p. Continental. Each complete airplane cost the C. A. A. approximately $2,300. Rated top speed is 100 m.p.h.; cruising is 92. Cruising range has been increased from the standard 382 miles to approximately 460 miles. Inset shows a C. A. A. ship's instrument panel and dual controls.

The Sikorsky S-44

WHILE a heated controversy continues between Pan American Airways and tiny, newly-formed American Export Airlines, engineers of the Vought-Sikorsky factory at Bridgeport, Conn., are busy converting the original design of the XPBS-1 patrol bomber (a U. S. Navy project) into a four-engined flying boat airliner for American Export. That company paid $50,000 for an option on the first ship and was to have exercised that option by March 15 by making a $638,000 down payment. As stated previously, the S-44 is the commercial version of the Navy's XPBS-1 long range patrol bomber. The original design was made in 1935. Present plans call for the American Export version to carry up to 39 persons, including crew. It is to be powered with four 1,050 h.p. *Twin Wasp* engines which are expected to give it a top speed of 225 m.p.h. at 7,500 feet. The American Export S-44 is planned to carry night sleeping accommodations for 12 passengers on its projected transatlantic run. According to Vought-Sikorsky engineers, the S-44 will have a cruising speed of 160 m.p.h. at 10,000 feet and a full-load range of 3,600 miles. This compares with Pan American's Boeing Clippers' 175 m.p.h. cruising speed with 40 passengers at a range of 3,100 miles. Maximum capacity of the Boeings, including crew, is 89 persons.



Dr. Adams is an able pilot and flies a Stinson like that used by All American Aviation.

FLYING INVENTOR

by

TED LEITZELL

The man who founded one of the world's most unique airline systems is a doctor who loves flying

LIKE most inventors who really make their mark, Dr. Lytle S. Adams (his device for picking up and delivering packages from an airplane in flight has made widespread feeder service possible) has led a varied and interesting life. He was born at Paint Lick, Ky., in 1883. He is a descendant of an old Virginia family founded by William Adams in 1680; and of the famous Revolutionary general, John Philip Schuyler. He grew up in Mount Vernon, Ky., but was forced to leave school at the age of 14. For seven years he worked in coal company commissaries, then started out to become a dentist and worked his way through St. Louis University as a newspaper reporter. At the urging of an instructor he went on to become an M. D. as well. This was back in 1905 and he had no more idea that he would eventually wind up in aviation than he had of making a flight to the moon by rocket plane.

In 1906 young Dr. Adams opened offices in Parsons, Kan. From the beginning, his practice was highly successful. But soon he met the traction tycoon, Cyrus Meade, who had financed the Wright brothers through their early experiments. Before long the young doctor was fascinated by airplanes. Shortly afterward he was on the west coast, specializing in oral surgery and hobnobbing with Glenn L. Martin. By 1909 he was flying on his own account.

As he wheeled his vintage crate over cities and villages where landings were hazardous or impossible, he thought of the day when airplanes would be on regularly scheduled service all over the country and of how important it would be for them to serve all communities. Even then it was evident that most of the smaller communities would find it too costly to maintain airports.

In the meantime his inventive flair and his surgical practice had continued hand in hand. He made his first transparent cover for a surgical incision ever used, placing it in position so he could watch the progress of a cleft palate operation. These inventions are in regular use today by oral surgeons.

In 1910 and 1911 there were a number of fatal accidents among flyers he knew and, at the insistence of his family, he gave up flying in 1912 and concentrated on his professional work. He moved to Washington and satisfied his urge for speed and mechanics each year by entering the annual motor boat derby between Seattle and Juneau, Alaska. In 1924 he resumed flying and began to get down to serious business on his pick-up device.

With dental modeling materials, threadlike wire and tiny model planes he began playing around. He molded a V-shaped chute, with a slot in its top surface, terminating in an opening at the apex. A drop of solder on the copper wire slid into the tiny slot and picked up the miniature load.

In 1927 he had his full-sized working model completed. The V-shaped delivery chute was 40 feet wide at the end of the arms and the apex was fitted with a trigger catapault to help the plane lift heavy loads. The cable connected to the airplane with a heavy shock absorber and could be lowered or drawn up by a winch and reel. At the delivery end the cable was fitted with a 2½-inch steel ball. The load to be delivered was fastened to the lower end of the ball with a copper break wire.

When the airplane flew over the chute with cable dangling, the load and ball slid into the chute. A casting at the apex stopped the load, breaking the slender copper wire that held it. The ball passed through the opening above the slot, striking the trigger that released the catapult, picking up the new load.

Larger wooden models patterned after this first model were demonstrated before Government officials. Although the top of the chute was less than four feet from the ground, 98 successful transfers were made in 100 attempts.

In 1928, backed by a New York investment house, he organized the Adams Air Express, equipped the then famous *S.S. Leviathan* with a chute and speeded mail delivery nearly a day by picking up loads with the Leviathan still at sea, and by taking mail out from New York after the ship had sailed. But the expected air mail contract did not materialize.

Then Adams planned the straight express service, along the lines that he later developed. All went well with preliminary plans, financing was arranged but it was in 1929 that the stock market collapsed. The whole deal had to be cancelled.

An outstanding trait of Lytle Adams is his tenacity (some friends call it bullheaded stubbornness; one even named a particularly ornery mule "L. S."). Despite the disappointments,

he insisted that he had a good product of vital importance and that he would put it over without retreating to the practice of surgery. Low on funds, he drove into Irwin, Pa., and stopped at a tourist camp. There he lived for the next six years, often cutting grass and doing other chores to pay his rent.

In 1933 Dr. Adams had an exhibit at the Chicago World's Fair. Three times a day his airplane swooped down over the lagoon and simultaneously deposited and picked up a bag of mail. Six minutes later the outgoing mail was at the airport, ready for connection with the major airlines. Over 4,000 letters were sent on the opening day; on closing day there were 8,000 letters, parcels and souvenir cards. The Chicago Chamber of Commerce, Postmaster Ernest Kruetgen of Chicago and the major airlines were all enthusiastic about the service. Adams planned a 200-mile feeder service, with shuttling direct from the roof of the new post office to the airport. It would be a continuous thing; the ship flying back and forth all day long, with landings only for refueling. But the air mail cancellations of 1934 ruined the entire program.

With mail contracts out of the picture temporarily at least, Dr. Adams concentrated on his plans for an express service. An analysis of parcel post figures shows that 48.3 per cent of all packages are delivered in the first and second zones, that 72 per cent are delivered within 300 miles of the shipping point. Convinced that there would be a real demand for air delivery of packages, Adams financed a survey by the Chicago Chamber of Commerce. The 8,850 questionnaires sent out drew an unprecedented return of 44 per cent (five per cent is considered satisfactory); 3,789 of the replies indicated interest in shipping their products by air, only 88 replies were unfavorable.

Next came the question of costs. After a careful analysis, Dr. Adams decided that he could handle air express at rates very little more than parcel post. He made agreements with department stores in Pittsburgh and Baltimore (three in each city) to deliver packages for them at standard parcel post rates plus a surcharge of six cents a package if they dispatched 30 or more packages a day and of 10 cents a package if they sent less than 30. He made similar agreements with firms in Morgantown, W. Va., where he organized operating headquarters.

It was 1937 before Tri-State was in operation and early 1938 before the present lines, connecting between Baltimore and Pittsburgh and radiating from those cities, were set up. Operations have not been profitable, but the full year experience of 1938 has turned up some interesting and valuable data.

During 1938, Tri-State operated three airplanes on regular scheduled service: one Bellanca *Airbus* with 2,800 pounds capacity and two Bellanca *Pacemakers* with 1,000 pounds pay load each. A Stinson with 750 pounds capacity was

(*Continued on page* 90)

This Month's Front Cover

THE color photograph on the front cover of this issue was made especially for POPULAR AVIATION through the courtesy of United Air Lines. The photograph above is a black and white print made from the original Kodachrome; compare this picture with the cover to see how it was cropped to fit the cover. The airplane in the picture is United's special Boeing 247D flight research plane. The camera plane in which Photographer N. R. Strohmeyer rode was one of that airline's Douglas DC-3's Pilot of the Boeing, visible in the ship's cockpit window, was Capt. C. R. Beindorf. The DC-3 was flown by Capt. E. P. Lott. The cover picture was snapped when the two planes were flying so close together that the buttons on Captain Beindorf's uniform could be seen by everyone in the Douglas. Maneuvering signals were given easily with mere nods. Because of the very close formation flying that had to be done for POPULAR AVIATION's picture, a half-hour preparatory conference between pilots and photographer was necessary. All close flying was done at approximately 6,000 feet in smooth air. Original size of our cover Kodachrome was 2¼x3¼ inches.

Radio for Airline Passengers

LATEST wrinkle for the airline passenger's comfort and enjoyment is the individual radio receiver recently installed on all TWA liners. Airline engineers, working with the Motorola Company, developed the new receiver. Weight of the entire unit for one airplane, including the master receiver and 21 individual receivers, is 35 pounds. The hostess aboard the airliner keeps the master set tuned to a nearby broadcast station and passengers merely plug in their receiver to listen. An additional novelty is the fact that TWA pilots now can talk directly to their passengers through their regular aircraft radio microphones (below). Pilots now give verbal position reports and point out interesting scenery below.

Elynore and her father, "Shorty" Fulton, are inseparable companions, especially in the air.

Fulton of Akron

by HELEN WATERHOUSE

Around northern Ohio the Fulton name is something of an aviation legend. Which is easily understood after checking over the case history.

NEARLY 40 years ago a bow-legged, round-faced two-fisted boy called "Shorty" Fulton, launched his aviation career out a haydoor of an old-fashioned barn near Kenton, Ohio. It was planned to be a parachute jump but it didn't turn out that way. The buggy umbrella that was to serve as a parachute turned inside out in the first 10 feet, dropping the surprised youngest member of the Fulton family into a surprised herd of his father's cows.

Fulton waited 30 years to make his next parachute jump and this one was successful except that he landed on a fence which was luckily not the picket fence type of his boyhood. In the 30 years between jumps, he had become a figure in the aeronautical world. He had built his own plane and he had built a big municipal airport out of a pasture and an orchard.

He had also taken unto himself a wife and had two fine daughters and a son who was the image of himself at the time of his first chute jump.

One of the daughters, a tow-haired little girl named Elynore, used to fly in the plane which Shorty constructed. It was a crude ship at best, carefully put together to be sure and Shorty had used his wife's kitchen—over her strenuous objections—to dry the dope on the wing sections. Elynore used to crawl into the seat in front of her dad and together they would bump over the field—which was always called "Fulton's"—and would take to the air for a spin to the grocery store down on the lake shore.

It got to be a rite and neighbors, craning their necks when the familiar putt-putt of the engine was heard would say, "There go Shorty and Elynore grocery-shopping." Recently, that same little Elynore, now nearly 20, still blonde and beautiful, again climbed into the cockpit of a ship on the same site where she used to take off with her father in that early contraption. She became the first student in the Akron area to take a flying lesson at the Government's expense and one of the three or four first women students to go aloft in Akron. Later she achieved her solo flight.

But the rough and bumpy ground of the old Fulton field had been replaced by concrete runways. The little cottage, where Elynore and her father and the rest of the Fulton clan used to sit around an airtight stove to listen to the brave tales of the early mail pilots as they flew in out of the storm, was gone. In its place was a modern brick administration building. The trim little ship in which Elynore took her CAA instruction, was a far cry from that early old machine which Shorty had rebuilt from a wrecked early model, with many months of hard labor.

Instead of flying down to the grocery store, Elynore's first flights were made over the site of her old home, under the watchful eyes of a Government-licensed

(*Continued on page* 82)

Fish Fly

Pilot Hadden stacks some of the special-built metal cartons, filled with fresh trout, beside his plane.

by BETTY L. McKELVEY

Seafood lovers away from the seashore should be thankful that Pilot W. J. Hadden was out of a job not long ago.

WHEN Pilot W. J. Hadden tells a fish story, it's likely to be true. For, since December, 1939, he has flown about 25,000 pounds of fish from Sturgeon Bay, Wis., to St. Louis, Mo. He generally carries from 1,800 to 2,000 pounds per trip in his 450 h.p. Stinson.

Although certain types of fish have long been doing their own flying, it is only recently that anyone got around to transporting fish to market by airplane. It is a comparatively new wrinkle in commercial aviation history and Hadden has hopes of building a prosperous business of his own out of this fancy type of "fish peddling."

Basis of the whole procedure is that fish is a more or less perishable commodity. After one of Lake Michigan's luscious lake trout has been packed and shipped from Sturgeon Bay to Chicago by truck, repacked and shipped by rail to St. Louis, then rehandled again for its trip to the wholesaler—and still again for the retailer—it's inclined to be only a shadow of its former self. To be sure, it's edible, but it's nothing like the fish served at resorts and hotels along the shores of the Great Lakes.

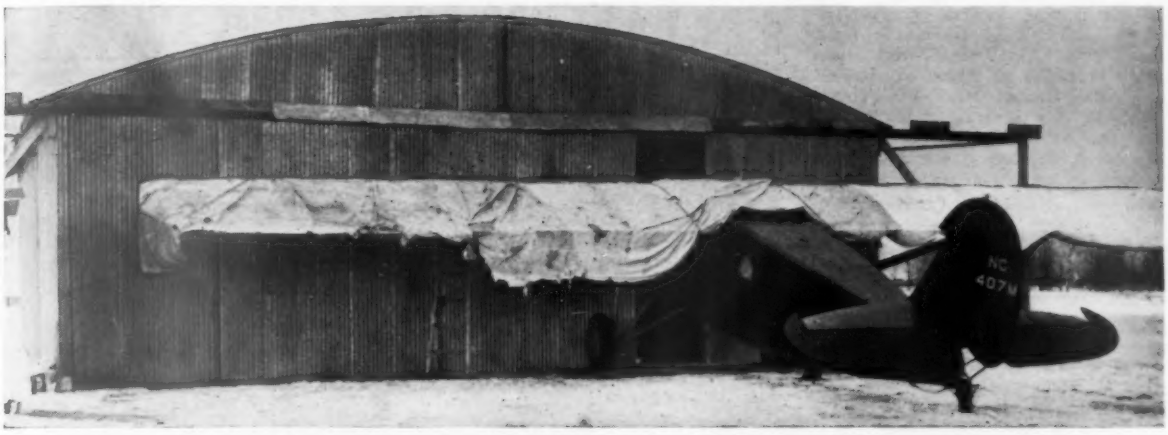
Former Wisconsin and Michigan residents, accustomed to the fresh-caught varieties, usually stop eating fish when they move away from the "fish country."

"The fish taste different," they complain. The fish do, too; they are older and the truck and train travel and numerous handlings required in shipping by this method softens the huskiest fish. Fish shipped by air not only are on the market sooner, but suffer little in transit and still are solid.

It is about 500 air miles from Sturgeon Bay (one of the fish centers of the middle west) to St. Louis. During the experimental runs made by Hadden last fall, fish were caught in the morning in the Green Bay branch of Lake Michigan and trucked directly to Hadden's plane. By noon the plane was on its way, arriving in St. Louis at 4:30. The trucks of the Kroger Grocery Company, with whom Hadden has a contract, were at the airport. The fish were on sale by 5 p. m. Thus it was possible for a St. Louis fish lover to dine on a lake trout caught in Sturgeon Bay that same day.

Naturally this "de luxe" fish costs several cents extra per pound, but the response of fish-fans to the new project leads Hadden to believe that he has hit on a good idea. Already he has had requests from other inland towns for a "flying fish line." Jack Hadden believes the scheme is going to work—and he should know. No newcomer to flying, he holds transport license No. 18716 and has 1S, 2S and 3M ratings, an instructor's rating and a radio-telephone operator's license. He also is aeronautical inspector for southern Illinois.

He learned to fly in 1924 at the old Packard field in Detroit. Eddie Stinson



Tarpaulins keep snow and ice off the wing of Hadden's Stinson as it stands outside a too-small hanger.

was his teacher. In 1925 he barnstormed around the country, flying passengers and taking part in air shows. After that he worked for Ford at Detroit, flying single-engined Fords and, later, the first tri-motored Ford.

Then he went to work for George Reil, when the latter owned and operated the Cia Mexicano De Aviacion, later taken over by Pan American.

He flew mail and passengers in Fords from Merida, Yucatan, to Vera Cruz before Pan American bought out Reil in 1928. He was in Mexico in the revolutionary days and later went to South America for Pan American, flying out of Lima and Ecuador. At one time or other he flew all the South American routes of Pan American and held eight foreign transport licenses before he applied for one in the United States. In November, 1929, he went back to Brownsville, Tex. He flew out of Brownsville until May, 1930, when he went to work for the old Union Electric Light and Power Company. He flew tri-motored Fords for this company from 1930 to 1936, carrying company officials around the country. He made surveys for new lines; with a crew of men, he did "trouble-shooting" up and down the high lines. After tornadoes or heavy storms Hadden and his crew would be sure to be out, one man watching for poles down, another listening on a radio connection for faulty wiring and so on. For this work he flew a twin-engined Boeing 247D. In June, 1939, the company's flying activities were abandoned and Hadden was looking for a job.

"I didn't particularly want to go back to airline work," he says. "I have a wife and baby in East St. Louis and I want to be with them as much as possible. But that's not easy with an airline job. You work only six hours out of the 24, but you never know what six hours. Neither do you know where you'll turn up at the end of your working day."

It was mostly chance that turned him to Door County and Sturgeon Bay. He had visited the Wisconsin resort country in 1937, when he took one of his employers to Sturgeon Bay in one of the Union Electric's Boeings. While there he met Dr. D. E. Dorchester, who now is president of the Cherryland chapter of the Wisconsin Aeronautical Association (also see POPULAR AVIATION for October, 1939). The doctor was interested in flying and the two became friends. Hadden visited Sturgeon Bay again last summer, and the two got to talking about job possibilities for Hadden and air promotion ideas for Door County.

Door County is known mainly for its tourists, its cherries and its fish. Dr. Dorchester, who often had eaten fish shipped inland by the usual methods during visits away from his home state, wondered whether fresh fish couldn't be transported by air without too much additional expense. Hadden liked the idea. "We'll try it," he said.

Hadden went to St. Louis and talked

Ed Allie, an official of the company that supplies Hadden's fish, discusses prices on that morning's catch with Hadden (right).

These trout are being packed in one of Hadden's special containers. Approximately 100 pounds of fish go into each carton.

to the wholesalers. That was a long, slow job. First, there was the expense and the matter of competition with the rail-and-truck fish. Also, were there enough people in an inland city like St. Louis who wanted fresh trout badly enough to pay several cents more a pound for them? The Kroger company investigated, decided in the affirmative and drew up a contract with Hadden.

Meanwhile Hadden had made experimental flights in a Curtiss *Robin* from Sturgeon Bay to Belleville, Ill., and had proved not only that the fish would sell readily but that the idea caused considerable comment. Fish dealers everywhere expressed interest, but Kroger got the contract. Soon it was obvious that Hadden would need a new ship—a large one. The *Robin* would carry only 500 or 600 pounds.

So he bought a Stinson SM6B with a 450 h.p. *Wasp* and flew it from Cleveland to St. Louis, where it was converted for transporting fish. For eight weeks a crew of from four to six men worked on it. Finally it was finished and christened *The City of Sturgeon Bay*. The C.A.A. gave it a special license on a Friday and on the following Tuesday morning Hadden was to take out insurance. On Monday morning the hangar in which the plane was housed caught fire and the $6,000 ship was destroyed. It was a tragic loss to Hadden.

But a day later he was on his way to Los Angeles, California, where, he had heard there was a second-hand Stinson that would serve his purpose. He is using that ship now, but plans to replace it as soon as he is sure of the financial success of the venture.

Hadden makes one Sturgeon Bay-St. Louis trip a week at the present time. The average is about four hours per trip. In his present Stinson he cruises at about 120 m.p.h. with a full load and good weather. He generally flies to Sturgeon Bay late Wednesday afternoon, stays overnight, has the fish loaded aboard the next morning and leaves the Cherryland airport about noon. He is in St. Louis before dark. The route between Sturgeon Bay and St. Louis, says Hadden, is easy to fly. There are innumerable airports through southern Wisconsin and Illinois where he can land if necessary.

Although he started the project in mid-winter, he has missed only one trip due to bad weather. On that day all airline flights were at a standstill in the middle west. From time to time, he has been forced to do a little instrument flying but never, he says, for any long period.

The hangar in Sturgeon Bay is too small to house the Stinson and, during the night before the trip to St. Louis, the ship must be covered with tarpaulins to protect it. Hadden encountered trouble in starting his trip south one day this winter. The thermometer stood at 23° below zero and mist froze on the wings. It took almost four hours to clear the wings. In cold weather he uses special heaters for the motor and oil.

Hadden's greatest difficulty, aside from the loss of his ship, the problem of mar-

(*Continued on page 68*)

Taylorcrafts in Palestine

THE first lightplanes to be flown in Palestine are three American-built Taylorcrafts, bought in 1938. Two of them are shown in the above photograph on the Tel-Aviv airport. Also in the picture is an airliner from Egypt (SU-ABO), two airliners from Great Britain (G-ABTJ and G-AAUE). Aircraft licensed in Palestine bear the letters VQ. The Taylorcrafts were purchased in New York and shipped to Palestine, where they have been operated by the Palestine Flying Service ever since. The first graduating class of 10 young men in the school of aviation conducted by the Palestine Flying Service received their pilot's licenses last April. The licenses were presented to the young flyers at special ceremonies at Lydda airport by the Palestine director of civil aviation and the territory's high commissioner. Flight instruction in the ships is under the direction of Edwin Lebovitz, former flying instructor at New York's Floyd Bennett Field. He bought the three airplanes for the Palestine organization. The ships are standard two-place side-by-side trainers and, according to reports, are popular with pilots in Palestine.

Autos for 7,000

GRAPHIC illustration of just how big "big business" aircraft manufacturing in this country is today, is the photograph of the Lockheed company's parking lot below. When this picture was taken, the Lockheed company employed 7,000 persons. As foreign orders continue to pour into such plants as Martin, Douglas, North American and Lockheed, parking space for their employes' cars has become more and more of a problem. Douglas, for instance, currently employs approximately 17,000 persons. Its annual payroll is over $25,000,000. Lockheed's growth, meanwhile, has been a comparative phenomenon. While only a few years ago the firm was one of the smaller aircraft manufacturers, today it has grown to where, as of January 15, it had a backlog of orders amounting to more than $40,000,000. Additional orders were, at this writing, expected to be announced by purchasing missions of the French and British. Britain's Lockheed *Hudson* reconnaissance-bombers are very popular.

AIRFOIL LAYOUT EXTENDED

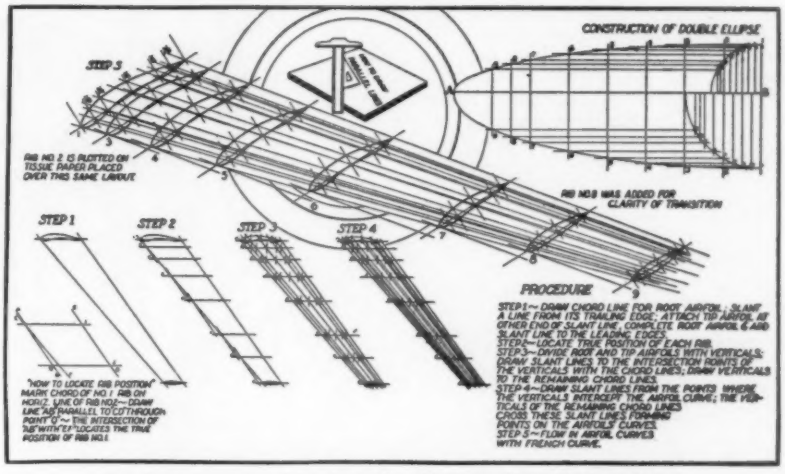
by ROBERT L. BROWN

Here is wing design and construction made simpler for either the home-builder or gas model designer.

THE usual procedure in plotting ribs for curved wings is to draw each rib similarly. To utilize changing airfoil sections (from root to tip) it is currently necessary to have a tapered wing (leading and trailing edges form straight lines). In the tapered wing the tips stall quicker than the root due to the small tip airfoils being unable to keep the flow of air from breaking away; the large root airfoils tend to preserve the airflow. It would then prove advantageous to delay this stalling action by embodying a more stable airfoil at the tip than at the wing root. Therefore, since the elliptically shaped wing is more efficient than the tapered type, and the changing airfoil sections are more effective than the wing all of whose ribs are similar, the writer decided to combine the two types to form a wing design of greatly increased possibilities.

Changing airfoils in a curved wing have several advantages (please note that the wing does not have to be elliptical in shape, but should be quite similar). A wing of this type can climb at a high angle of attack due to the late stall induced by the stable tip airfoils. Greater altitude may be attained and thus longer duration. This wing is less apt to roll around the axis formed approximately by the root chord line, the reason being that stability is increased by having the lift concentrated as near the center of the wing as possible; the new wing guarantees you that attribute. Directional stability is increased for two reasons: first, the stable tip airfoil is in continuity with the wing tip shape, and effective in minimizing tip vortices (swirl); second, the lower lift, more stable tip airfoils reduce drag at the tips and therefore, the turning forces directionally. With the advantages of this wing stirring the innermost visions of you designers who want the best, let's go through the procedure in greater detail.

Secure a generous sized piece of paper for the layout. If it isn't too inconvenient you might make the layout as large as shown in the drawing (in comparison with the wing plan). I believe this to be about the maimum size. For small gas models this layout will be fine; it will minimize the number of ribs that will overlap. For large gas jobs the difficulty in drawing the layout seems reason enough to reduce its size. Thus, more ribs near the root will overlap. To obtain the longest layout turn your paper diagonally so that you can work from corner to corner. The more oblique these slanted lines the more accurately placed will be your points; the slanted lines will more nearly cross the verticals at right angles. For full size airplane and large gas job wings it seems advisable to draw the layout to scale. After doing that it is necessary only to enlarge (with dividers) the same measurements at which you arrived in the smaller drawing. After drawing the chord line of the large root airfoil up in the left hand corner of your sheet, slant an oblique line across the paper from the imaginary rib's trailing edge (chord line). At the lower end of this trailing edge line attack the chord line of the tip airfoil. Slant a line to the leading edge of the chord lines; if the primary structure of your layout seems satisfactory you are ready to continue. For the sake of simplicity always draw the chord line through the leading and trailing edges. It is true that doing this may possibly tilt the airfoil section slightly in the layout, but that doesn't interfere with plotting ribs. After drawing in the root and tip airfoils of your own conception you must locate the true layout position of each rib. This is done in the following manner: (1) starting from either the leading *or* trailing edge lines measure with dividers the width of the desired rib chord on any line parallel to the root and tip ribs. (2) Draw a slant line from the extremity of your measurement, parallel to the slant line from which you began measuring. The point where this new slant line intersects the slant line of the leading or trailing edges locates the *true* position of the intermediate rib chord line. Parallel and perpendicular lines to any oblique line may be had by placing the hypotensus (long sides) of either 45° or 30-60° triangles together. This gives the same result as tilting your "T" square as illustrated. Locate the intermediate rib positions beginning with the smallest rib. You may ask, "Why locate the ribs starting with the smallest one and working toward the root rib? The answer to this question is very important. By following this procedure the number of ribs which must be plotted on tissue paper or overlapped on the drawing is automatically determined. If you started with the root rib and worked down, your slant lines wouldn't converge quickly enough and would run off the paper; you would have no way of determining how long your paper should be. Not only that the layout would be entirely too long. Next, divide the root and tip airfoils into fractional divisions, the number depending upon the degree of accuracy desired. Draw slant lines between the points formed by the perpendiculars crossing the chord lines. At these points on each intermediate rib draw verticals. At this step the light of understanding should burn a little brighter. Draw slant lines from the points (on the root and tip airfoils) where the perpendiculars cross the airfoil curves. Where these slant lines intersect the verticals of all the other ribs, points are automatically determined on the curves of all intermediate airfoils. Thus, in finishing the layout it is necessary only to complete the airfoils with a French Curve.


CONSTRUCTION OF DOUBLE ELLIPSE
STEP 5
RIB NO. 2 IS PLOTTED ON TISSUE PAPER PLACED OVER THIS SAME LAYOUT
RIB NO.5 WAS ADDED FOR CLARITY OF TRANSITION
STEP 1
STEP 2
STEP 3
STEP 4
PROCEDURE
"HOW TO LOCATE RIB POSITION"
MARK CHORD OF NO. 1 RIB ON HORIZ. LINE OF RIB NO.2 — DRAW LINE "AB" PARALLEL TO "CT" THROUGH POINT "O" — THE INTERSECTION OF "AB" WITH "EF" LOCATES THE TRUE POSITION OF RIB NO.1

This drawing, prepared by the author, illustrates his method of design.

In using tissue paper the root rib need not be drawn again. Needing indication are the vertical divisions, slant connecting lines, and points on the curve. To complete, fit the desired chord width between the slant lines of the leading and trailing edges, draw verticals, place dots on the curve, and flow-in airfoil.

Gulled wings may be plotted by considering one-half of the wing in two parts, namely from the maximum chord to the wing tip, and from the maximum chord to the wing root. Two layouts

must be made in order to do this.

The double ellipse was used to illustrate these principles because it is simple, and more important still, a regular geometric figure. To construct the double ellipse (with help of drawing) the horizontal radius of the construction arc is equal to the distance from the major axis (line AB) of the ellipse to the leading edge (or trailing edge) of wing at the root. Thus, two arcs must be drawn. The horizontal radius of these arcs are divided into the same number of divisions into which half of the wing span is divided. Therefore, the points where the verticals of the construction arc cross the arc itself are projected out to the corresponding divisional verticals of the major axis (one half wing span).

In conclusion, the writer hopes that both the model designers and big plane designers, armed with this new wing design will succeed in breaking a few records.

END

P. A. Trophy

CHAMPIONSHIP trophy of the Third Annual Southwestern Soaring Contest, to be held at Wichita Falls, Tex., June 9 to 23, is being given by POPULAR AVIATION. The trophy, shown above, will go to the pilot with the highest number of points at the end of the two-week meet. According to Jack Begley, director of the meet, attempts will be made to set new altitude and distance records.

Engine Dope

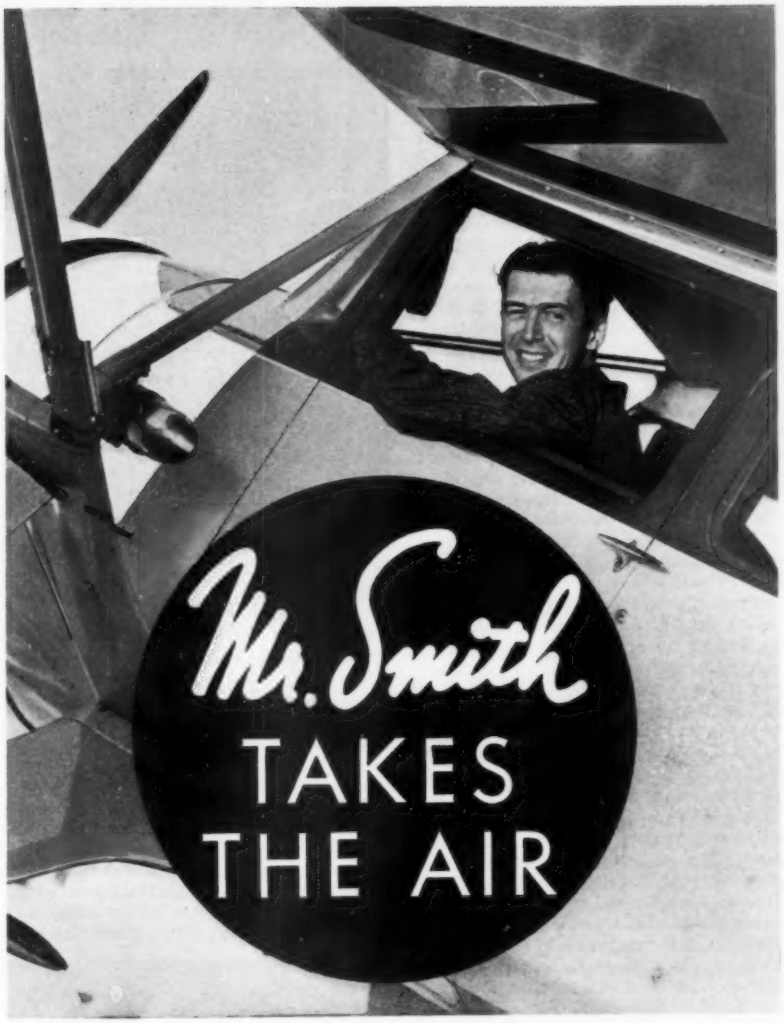
AN imaginative American Airlines statistician recently compiled the following: Each piston within the average engine on one of its Douglas airliners travels 11,836 miles between overhauls. Each valve opens and closes 272,700,000 times; 4,908,600,000 sparks jump the gap in 18 spark plugs (equaling a single spark 930 miles long). The engine's supercharger impeller revolves 3,817,800,000 times (the equivalent of 85 trips around the equator), the crankshaft revolves 545,400,000 times and the propeller makes 374,962,500 revolutions.

Italian Tricycle Ship

FOLLOWING in the footsteps of recent American developments, the Italian Saiman company has been experimenting with the two-place tricycle-geared monoplane shown in the above photograph. Patterned somewhat along the lines of the American Stearman-Hammond, the Saiman LB-2 is powered with a 130 h.p. inline air-cooled Alfa Romeo engine, similar to the Stearman-Hammond's 125 h.p. Menasco. Like its American counterpart, the Italian ship also is a pusher. The LB-2 is built entirely of wood and is covered with plywood and fabric. Dual controls are standard. The tricycle gear is equipped with long-travel shock absorbers and brakes. When the above photograph was taken, the LB-2 was in the midst of test flights. Its designer, Signor Francis Lombardi, had granted the license to construct the ship to the Saiman company in Rome. Although the LB-2 can be had with a 110 h.p. engine, the standard model is powered with the 130 h.p. power plant. With the latter engine, top speed is 133 m.p.h. Cruising speed is 118 m.p.h. and the LB-2's range at that speed is 413 miles. Landing speed is 43. Service ceiling is 16,400 feet. Empty weight is 2,808 lbs., useful load is 1,268. Span is 38.3 feet.

Airline Pilot Checkers

A SMALL fleet of single-engined Stinson *Reliant* monoplanes, some of which are shown below, currently are operated by American Airlines for advanced pilot training and route survey work. Would-be pilots for that airline are put through a comprehensive ground and flight course before they become co-pilots, despite the fact that all new co-pilots actually are experienced airmen. The line now has an elaborate pilot training school at its base at North Beach airport, New York. Newly hired pilots must take the elaborate, expensive course which covers everything with which an airline pilot is concerned. Following the completion of the ground work, he is given several hours of flight work in the Stinsons pictured below. This includes practice instrument flying with the ship's cabin windows on the left side covered with curtains. The American Airlines instructor rides in the right hand seat, giving the new pilot instrument flight and approach problems to work out in actual flight. In these Stinsons, the new pilot also becomes familiar with the operation of the radio beams.



Mr. Smith TAKES THE AIR

by HILL EDWARDS

Jimmy Stewart is an aviation bug if ever there was one in Hollywood. Now he has a new plane and a yen to visit the whole U. S.

JIMMY STEWART scratched his head the other day, trying to remember when he first wanted to fly. Finally, he just gave up. The bug had been with him ever since he could remember. He's flying today because he can't help himself. He's just nuts about it, that's all.

Yes, Jimmy Stewart of the galloping tintypes—that long, tall, thin guy with the bashful face, hands and feet. The fellow with the shock of hair that he doesn't seem to be able to get up out of his eyes. Jim gives you that self-deprecating grin of his when he tells of his first experience with airplanes. His father owned a hardware store in Indiana, Pa. Jim was scarcely into short pants, not out of them, when the first barnstormer came through.

"Dad," he announced, "I want to fly. I'm going to fly."

The elder Stewart looked up from a saw he was wrapping for a customer with:

"Run along, son."

Jim doesn't remember where he got the money. He'd like to say he earned it selling papers or sweeping up the store. But he is definitely no Horatio Alger character. And he can't help telling the truth.

"The truth is," he says, "that I saved it from nickels, dimes and quarters my father gave me."

It took a long time for Jim to collect $15, the standard pre-war price for airplane rides. But he made it. And when a barnstormer named Jack—Jimmy can't recall the last half—came roaring through in an old pusher with a couple of tin buckets tacked onto the lower leading edge, Jim faced his folks.

"I have to go for a ride in an airplane," he said. "I've saved the money."

It seems that there was considerable consternation in the Stewart family that night and for several days thereafter. Jim produced, from a hiding spot, a cheap pair of goggles and an old cap, which he put on backwards. Father gave in. Mother was slower. Finally, she agreed. She appeared at the field for the epochal moment when the first member of the House of Stewart soared skyward. With her was the family doctor.

"Just in case," she explained.

The doctor wasn't needed. Jim had a grand time. He returned home immediately and began the construction of a model. At about the time the model was completed Jack, the pilot, came back through. Jimmy had no $15 this time, but the pilot had a good memory and a laugh at Jim's sales talk.

"You see," said Jim, showing up with his model, "I have to test this. Now if you'll let me go up and toss it out—"

Jack might have refused the first time, or the second. But when it went on for a week, he finally agreed to take Jimmy and his model up. At a good altitude, Jimmy tossed the model overboard.

"It didn't even spin," Jim recalls. "It just dived. Right on down."

This is why, maybe, Jim chose to be an architect instead of an aeronautical engineer. At any rate, he went through grade school in the town of Indiana. Whenever a plane came through—there was no regular airport at Indiana and it was a fertile pick-up field for barnstormers—Jimmy got to the field. Sometimes he chiseled a ride. Sometimes he paid for it from meager savings.

"But I always got it," he adds.

Then came Mercersberg Academy. Now and then he'd get away to take a hop. But not often. He had to wait table and he had to run the furniture concession. Later, when he went to Princeton, he was too busy for much flying. There wasn't much to be had; prices for instruction were too high.

Today, he grins and says:

"Boy, these are the days! Would I like to get into one of those intercollegiate flying meets! Things happen fast."

All during this period Jimmy kept a scrapbook. He thinks it's valuable today. He's a star in motion pictures now. Maybe, in the United States, there are people who are saving clippings about him. But in those days and now aviators were—and are—his top men. He says:

"I think I've saved every story ever written about Lindbergh. I have thousands of 'em. I've a record of every distance flight made since the World War. I've records on Nungesser, Coli, Chamberlain, Admiral Byrd, Bernt Balchen and Jimmy Mattern. I'm the number one flying fan of America."

As we said, Jim started to be an architect. He graduated with a Princeton B.S. with that in mind. But things happen to Jimmy. You see, he plays an

accordion. During the Princeton days, when not drawing plans for houses, he appeared in shows. When that final summer came, some of the other actors got jobs in a summer playhouse at West Falmouth, Mass.

"You can play that so-called musical instrument in the tearoom next door," they told him.

This was in 1932. It seems that Jim was a better actor than the others. He tried out in a play, landed on Broadway and worked very hard until 1935, with never a sight of an airplane. Late in 1935 Metro-Goldwyn-Mayer brought him to Hollywood to work in pictures. Somehow, he just happened to be a smash hit.

Leland Hayward, husband of Margaret Sullavan, is an agent for actors, stories, directors and such. Leland Hayward is Jim's agent. Hayward has owned several Wacos, has been flying for many years, is a famous sportsman pilot and is on the board of directors of TWA.

"I took a couple of rides with Hayward and then I knew I had to fly," Jim says. "I had money, so I could afford it. And sometimes I had time."

He sought out Cecil Smallwood. Smallwood has taught a lot of Hollywood people to fly, including Ruth Chatterton. Jim was a little slow. He liked to take things easy. He had about 14 hours before Smallwood turned him loose. Like all the boys who feel their way through, he's turned out to be a sane, careful pilot.

He got a 2s land rating private in 1937. Right now, he has about 250 hours. He still is under Smallwood's guidance out at Clover Field in Santa Monica. Smallwood has a Fleet, a couple of Fairchilds and a Stinson "105". Jim took turns on them, flying to San Francisco, Palm Springs, San Diego and Phoenix. He has yet to have a forced landing of any kind.

In 1938 Jim let himself in for something—right up to the neck. One of his heroes, Jimmy Mattern, visited him on the set. Jim asked Mattern where he was going.

"I'm flying back to the National Air Races," Mattern replied. "How's about going along?"

Jim hadn't been to an air race for a couple of years. He'd attended the nationals religiously from 1930 to 1934.

"Why, sure," he said. Then, as he started into a double-talk routine, Mattern turned and left the stage. Jim's "See here, Mr. Mattern!" was just left hanging in the air.

The picture finished Saturday. Mattern was leaving Sunday night. Jim had to be back at work in the studio—the director told him he'd have to pay the salaries of 250 extras, amounting to $2,500, if he kept them waiting Tuesday morning when the new picture started.

Jim and Mattern took off at 10 o'clock Sunday night in a Lockheed "12" and landed at Cleveland at 1:10 p.m. to be greeted by Cliff Henderson after a nonstop flight from Burbank.

"Throughout the trip," Jim says, "I

(*Continued on page 76*)

Shipping Bombers

In the background are sealed and taped bombers ready for loading for shipment.

THE airplanes shown above and below are Lockheed *Hudson* reconnaissance-bombers. They are being prepared for shipment to Great Britain as part of the large order for this type airplane received some time ago from the Royal Air Force. The special requirements incidental to the shipping of these ships across the Atlantic are the subject of these photographs. Because of the prolonged exposure to highly corrosive salt air during the trip across the ocean, each airplane must be prepared for shipment in a special method which precludes salt water corrosion. Below left, an engine is being sprayed with a preservative coating after which it is sealed up like those seen in the picture above. The man below right is taping up bomb bay doors with waterproof tape. Picture at the bottom of the page shows many carefully tagged parts being prepared for shipment. The ships in the background of the above picture are ready to be placed aboard a British freighter; the plane in the foreground is going through disassembly. British mechanics reassemble them on arrival in England.

Spraying engines (above left) prevents salt water corrosion. Doors and bomb bays are taped (above right). Disassembled parts (below) are tagged for reassembling.

Evelyn Kilgore (right) poses with George Hopper and Herbert Stacy, two students.

LADY WITH WINGS

by

STEPHEN BATES

Evelyn Kilgore is an amazing lass. She is a flight instructor in the C.A.A. program and has taught more than 80 fledglings how to fly.

IT'S a lot of fun to watch a would-be pilot condescendingly approach Evelyn Kilgore—small, slim and blonde—who presides over the destinies of Tri-City Airport in southern California.

"I want to fly," the prospective student says. "Is there someone around here who can teach me?"

"I can," says pert Evelyn.

You can almost hear the clunk of the falling male nonchalance. The candidate's mouth opens like a hangar door. Before he can recover, Evelyn adds:

"Of course, we have a man—if you prefer him."

But by this time Evelyn has the candidate by the arm and is heading him in the general direction of a *Cub*. In fact, she's telling him that maybe he'd just better hop around the field with her. Later, if he wishes, he can have masculine assistance at the controls. One hop usually sells the customer.

Proof of this statement lies in the fact that Evelyn, to date, has soloed 75 men and five women without denting a wheel pant. Further proof lies in the fact that she, with more than 1,200 hours in her book and an instructor's rating, is now teaching 10 students from the San Bernardino Valley Junior College under the C.A.A.

Add to this run-of-the-mill operations and you have a very busy young woman doing her stuff on a thriving airport. She's right in the center of about 100,000 population.

Not only does she do a good job of teaching the lads and lasses how to handle the controls, but she's a good business woman as well. She and her partner are buying the land where Tri-City Airport makes its home—a field situated in the geographical center of an area embracing San Bernardino, Colton and Redlands, all in California. She operates two *Cub* "50's," a *Cub* "40," a Waco "F" and a Curtiss *Fledgling*.

As far as she knows, she's the first woman to get her instructor's re-rating. She studied the C.A.A.'s little blue bible for months, flew into Glendale on Friday, October 13, and took a day of flight tests and two days of written and oral work. Two men arrived at the same time. One lasted one day and was washed out. The second lasted two days. Evelyn got her ticket on the third.

And she is also pretty sure that she started her first student under the C.A.A. ahead of any other woman in the country. The day was Monday, December 11. All 10 are merrily hopping their various ways around the airport under Evelyn's careful tutelage.

So many men make her unhappy. That is, not because there are so many men. But because there are so few women.

"Girls," she says, "make good flyers. They learn slower because they don't understand the mechanical end of flying the way men do. But they are smoother and more careful. Men like to 'kick a ship around.' Sometimes they get a little foolish. Women respect a plane more, feel their way into the business of flying better."

Of course, Evelyn says women learn slower—and came through to a solo in eight hours some five years ago under Lt. Joseph Brier's tutelage. She must be the exception that proves the rule. But, to go on with her thoughts:

"Women don't get as far as men do because they fritter around. They have to spend money and time on clothes and cosmetics and things like that. They just about get started and they fall in love, too. The next thing you know they've dropped out because the boy friend isn't interested in flying.

"Men are different. When they start flying they stick to it. If they have a girl, they bring the girl to the field. Pretty soon she's flying, too—sometimes."

Evelyn can prove that. Not long ago she wound up the propeller on the Waco and headed southeast for Yuma. Her two passengers for that dusty Gretna Green excursion were Marianna Kraak, a student, and George Gardner, III, another student. After a ceremony before a judge, she flew Mr. and Mrs. George Gardner III back home to Redlands. Both were students. Evelyn exults:

"That's what I call having mutual interests to make a success of marriage. Marianna worked in a Los Angeles bank, started to fly, and came back to Redlands. George was learning to fly,

too. He encouraged her, she encouraged him and look what happened!"

Evelyn has a great deal of confidence in herself and her flying. Not the cocky type. She hasn't any fear. She's been completely through the mill and she thinks flying's stimulating, fun, romantic and colorful. The reason she is so successful with her students is that she doesn't make much ado about learning. You just go out and fly and she helps a little and pretty soon you have your license. That's all there is to it. When she was flying down at Beaumont—wait'll you hear about Beaumont—she had half the girls in town flying as well as the men. The only trouble, as she has pointed out, was that the girls spent too much money on dresses, dates and nights out instead of simulated forced landings.

"You don't tell 'em how hard it is," she says, "you tell 'em how easy it is. In fact, one of the reasons I get by is that psychology plays a part in my business. The fellows see a girl teaching and they say to themselves—'If it's that easy, I guess I can learn myself.'"

The curly-headed instructress was born in Medford, Wis., April 12. She lets the boys guess the year. She wasn't a Kilgore until she got married. She's really a Pinckert. There are lots of Pinckerts, the best known being her brother, Ernie, who is one of the best football players in the history of the game. She doesn't like to bring that up. She wants to get along on her own reputation. In all, she has five brothers and four sisters. She's the youngest girl. She lives in San Bernardino with the family. The only other flyer in the family is Victor, one of her brothers. He's just learning.

She divides her life into two parts. BF, for before flying, in which she says nothing in particular happened and AF, for after flying, when the fun really began. To keep the record straight, she went to school in Willets and Santa Rosa, Calif., high school in San Bernardino and business college in the same place. On graduation from the latter institution she settled down to a prosaic job with the Southern California Gas Company. One of the men there, Howard McCook, owned a Curtiss *Fledgling*.

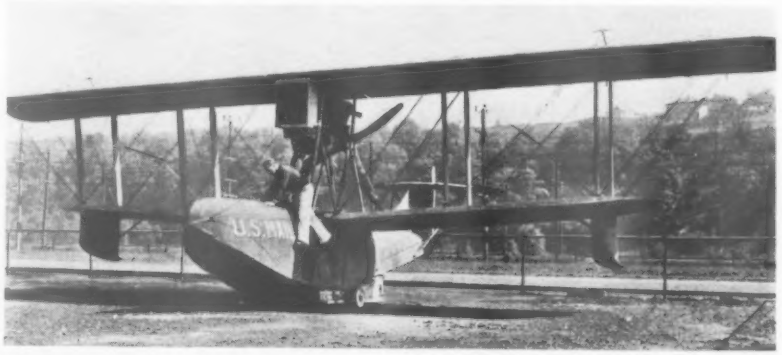
"In 1934," she says, "Howard took me for my first ride."

She couldn't stay out of airplanes. Lieutenant Brier gave her dual in a Great Lakes and an Eaglerock. It looked like 10 hours until solo when she started, but she whittled two hours off the clock. This was at a field known as Arlington, south and west of Riverside. She started piling up hours. The business of supplying gas to happy California households got in her hair. So she gave that up. From Arlington she went to Colton airport, proprietor of one *Cub* "40". Here, she went into business—and had a very unusual and unhappy experience.

"I was flying off a cow pasture at Colton," she relates. "Every night, after dark, I flew the ship back to Arlington so that it could be hangared. I'd take

(*Continued on page* 88)

Retired Veteran



WEATHER-BEATEN and tattered but still virtually intact, the old Boeing B-1 flying boat in the above photograph recently has been incorporated into an historic exhibit in Seattle by the Boeing company. The B-1 was used to carry the first international airmail between Seattle and Victoria, British Columbia. The first flying boat ever to be built by the Boeing company, the B-1 offers striking contrast to Boeing's gigantic ocean-flying Clippers now in use. Now almost 21 years old, the old flying boat was completed in July, 1919. It was flown continually until 1927 when it was retired from active service. Since that time, it had been left standing, unused. During its flight career, however, the B-1 had flown more than 350,000 miles in 77-mile hops between Seattle and Victoria. When finally retired, the veteran had worn out six different engines but still was airworthy. Now owned by Alan Blum, president of Northwest Air Service, Inc., it was at the instigation of the Seattle chapter of the National Aeronautic Association that the B-1 was hauled to Seattle and reassembled on Boeing Field. It used a 200 h.p. Hall-Scott engine, top speed was 95 m.p.h., and it weighed 3,650 pounds loaded.

Stranded

PILOT LES COOK was flying a load of passengers and freight over northern British Columbia in his Waco YKC recently when the ship's engine suddenly began to vibrate, threatening to break up the ship in the air. Quickly he chose the likeliest landing area in the snow-covered wilderness and headed for a dead-stick forced landing. On the way to earth he had time to frantically describe his predicament and approximate location over his radio to another airplane with which he had been in contact. The other ship, an American-built Fairchild flying out of Juneau, Alaska, was flown by another veteran of the far north, Lon Cope. Following Cook's directions, Cope located the stranded Waco and landed beside it. Cook had managed to get his ship down on a frozen river, the only safe landing area within a radius of 30 miles. Cope transferred some of the Waco's passengers and cargo to his ship and flew them out to Juneau. Soon after his arrival a sudden rain storm left the airport in such a condition as to make flying impossible. Finally a dog team was sent to the rescue of Cook (below) and his other passengers. The Waco had to be left there for two months until a new engine could be installed.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

FOUR thousand certificated pilots registered with the AOPA and 136 AOPA Units operating throughout the United States. That's the score as we start thinking about spring flying weather. One of the toughest winters in history has passed. Aviation came through with an enviable record. Scheduled carriers set an almost perfect record and miscellaneous aviation made tremendous strides in safety. We once had about one fatality for every 13,000 hours of student training. This winter the student training program has completed *150,000 student training hours with but one fatality* and that was apparently due to a structural failure of an aircraft in an abnormal maneuver. This calls for a pat on the back for the carefulness of re-rated instructors.

Help for Instructors

The Government now is designating 19 aviation schools where qualified pilots may go for a ten-day course and examination for instructor's re-rating. It's estimated that about 700 pilots will get a chance to take this course. If you have sufficient time to qualify and are interested in getting your instructor's rating, contact your local C.A.A. inspector and get the dope.

Recently the C.A.A. provided for the training, up to solo flight, of the director of flight training at each college. The experimental advanced training course soon will start at 12 of the original 13 colleges. Georgia Tech, one of the original colleges, will not continue with the advanced experimental course. This course is designed to take trainees through an additional 40 to 50 hours and qualify them for their Limited Commercial certificate.

More for Non-College Students

Congress came through handsomely with the appropriation for civil pilot training for 1940-41. *The AOPA is interested in increasing the proportion of that money allocated to non-collegiate student applicants.* Not that we think less of the college boys; but we also have a soft spot for the boys and girl who never got a chance at college. AOPA has presented this viewpoint in Washington. The viewpoint is thoroughly sympathized with. It seems almost assured that there will be a sizeable increase in favor of the non-collegiate group next year.

Spread the Help Thinner

The AOPA believes that the average student, either in or out of college should pay at least one-third of the expense of his flight training. Hence, if it costs $300 to get his flying certificate, the student puts up $100 of it. It also means *there could be one-third more students trained.* If a fellow isn't interested to that extent, he isn't interested at all. Thousands learned to fly when it cost $25 an hour and they had to put up every cent of it themselves. If a fellow isn't willing to make sacrifices for aviation, he'd better turn to something he is willing to sacrifice for. The things we get for nothing usually don't stay with us for a very long period.

Here's One for Comment

Why are not the National Guard squadrons logical training centers? Most of them are made up of thoroughly experienced pilots recruited from the Army Reserve and the airlines. The Air Corps has provided its own training schools at Randolph, Kelly and nine additional centers. Vacancies in the National Guard have been selected from these graduates. More recently, candidates have been pre-selected for Army training, who, after completion of their training are assigned to the National Guard Squadron sponsoring their training. In case of war, the airline personnel would be more essential on their jobs than in front-line squadrons. The civil airlines are the heart of our national air defense mobility. The older officers would immediately go into administrative jobs and training centers. Would it then seem to be sound common sense for these National Guard squadrons to be equipped with a variety of aircraft and to serve as training units, available to the qualified pilots in various areas? These men might give their services in training while making their living in civil pursuits. The average National Guard squadron doesn't need to take its hat off to any outfit in regulars and does a comparatively excellent job. But as a channel which might initiate civil pilots into military procedures, it is frankly not serving its purpose. If the average squadron had three times as many airplanes and each airplane cost just one-third as much and was flown three times as much by three times as many pilots, we would be getting somewhere. If we want to build a real reserve, let's take them into the National Guard squadrons young, keep them there for a maximum of 10 years, then retire them to make place for other youngsters. The AOPA ventures respectfully to call to the attention of the military authorities that hundreds of young fellows are knocking at the door and should be given every consideration.

The National Airport Program

We are in desperate need of a national airport policy. *A policy must be*

Examples of AOPA educational activities. At right is a poster used in safety campaign. Hundreds have been circulated to points where airport obstructions offer a hazard. Below is an AOPA contribution to airmarking campaign. Cards are dropped from AOPA plane.

YOUR TOWN IS NOT AIRMARKED!
The AOPA Survey Ship has just flown over your town. The pilot will report your town as not properly marked for safe air navigation! Take this notice to an official or local newspaper and demand immediate action!
For Details On Airmarking Write To:
AIRCRAFT OWNERS AND PILOTS ASSOCIATION
NATIONAL SERVICE HEADQUARTERS
TRANSPORTATION BLDG. CHICAGO, ILL.

established before a program can be inaugurated. Municipalities cannot continue to build airports and maintain them. It's time somebody sat down and did some hard thinking on this subject. Let's examine it:

Federal Participation

Any sound airport development must be on a co-operative basis. The Federal Government has a trinity of interest: national defense, postal service and foreign and domestic commerce. What the Federal Government needs is landing and take-off areas and lighting and navigational aids to keep those areas in constant operation. The Federal Government has a logical and sensible reason to participate in a nation-wide program. Federal expenditure should be limited to the development of terrain and the installation of the flight aids which make the terrain effective. Some people think the Federal Government should bear the whole burden. That's just one way of turning aviation over to the Government—and about the quickest way. The Federal Government has responsibilities for the development and maintenance of landing areas, adequate to serve the job with which the Federal Government is charged.

State Participation

Each state has a logical participation in an airport program. Every state government should have definite plans for industry, commerce, re-creation and other planned activity within the state. States will want adequate airports located where no trunk Federal airway extends. They will want to serve the express and freight needs which will soon be a part of air commerce. They will want fields to serve their universities and their vacation centers and for the training of their young people. Therefore, the state should participate in a co-related program with the Federal Government. The state should spend its money for the improvement of approaches, the burying of power lines, the laying of adequate highways to serve the airports and the removal of obstacles which now exist. The state should be charged with helping the Federal Government to maintain the terrain of an airport within its boundaries. There are interests which may not want the states to have anything to do with a nation-wide airport program. Their real reason is that they are afraid the states will use a gas tax on aviation for this purpose. If they can't understand that the Federal Government cannot possibly do business with 3,000 separate counties and with many more thousand separate towns, they'd better get out their primers on political economy. We can't develop a national airport system and by-pass our credited channels of government. To say that aviation cannot develop and go through those channels of government is to either say that aviation will never develop or that they mistrust the governments of all the 48 states.

Municipal Participation

We have no right to demand that any municipality build and maintain a great airport at a loss which keeps the

(*Continued on page* 86)

DeHavilland Production

ONE of the trimmest British lightplanes is the DeHavilland *Moth Minor*, shown in quantity production in the above picture. Since the beginning of the war, many of these ships have been used throughout the British Empire as primary trainers. Intended as a sport-trainer, the *Moth Minor* is a two-place folding-wing monoplane powered with a 90 h.p. Gypsy engine. The ships shown above are part of several orders for the type in from Canada, South Africa, Australia, India, the Malay States as well as the British Isles. One *Moth Minor*, seen in the center background of the above picture, bears the white cross on a red background which identifies Switzerland. Top speed of the *Moth Minor*, loaded to 1,500 pounds, is 118 m.p.h. at sea level. Cruising speed is 100 while its stalling speed is rated at 47 m.p.h. Maximum range, with 13 Imperial gallons of fuel, is 300 miles, while its service ceiling is 16,000 feet. Wing span is 36 ft. 7 in., length is 24 ft. 5 in. The *Moth Minor's* construction is entirely of wood. The wing is plywood-covered. It also is fitted with a perforated flap. Brakes and tail wheel are standard.

A Navy Newcomer

ONE of several similar types of scout-observation aircraft currently being built for the U. S. Navy is the Vought-Sikorsky XOS2U-1 (Experimental, Observation-Scout, Model No. 2, Vought-Sikorsky, Modification No. 1). A seaplane version is shown below. Powered with a nine-cylinder 400 h.p. *Wasp Junior* engine, the XOS2U-1 can be used either as a landplane or seaplane; its chief function will be that of a seaplane operating from battleship or cruiser catapults to direct gunfire and to conduct long range observation scouting missions. The ship is an all-metal monoplane and carries a crew of two. Among the ship's unusual features are two high-lift devices: a new "deflector plate" flap on the wing's trailing edge, and "drooping" ailerons. Spoilers also are fitted in the wings to supplant the ailerons at low speeds. Span is 36 feet, gross weight (seaplane) is 4,764 pounds. The Vought-Sikorsky factory is working on a $2,103,800 Navy order for these.

METAL IN THE AIRPLANE

By RAOUL J. HOFFMAN

SINCE 1909 the use of metal in airplane designs and structures has steadily replaced wood and fabric. Brazed steel tubing in 1909, welded steel structures in 1912 and even an all-metal airplane in 1915 did not popularize the general use of metal for airplanes. Surprisingly, metal propellers used in 1909 were replaced by the cheaper wood propellers.

This disfavor of metal for airplanes by the designers was not only the outcome of the inability to procure expert metal workers or suitable products, but the total absence of reliable formulas to estimate the exact stresses in very thin sections. The high cost of equipment and the uncertainty of standardized aerodynamic sections was another drawback. At present, when nearly all of the flying characteristics of an airplane can be closely predicted and the performance of machines of similar designs do not differ in a great amount, metal airplanes may be produced in quantity without the danger of being outclassed in the near future.

Years of research, tests on full-sized units, development of special manufacturing equipment and process, enabled factories to reduce not only weight but also cost, and at the same time secure the necessary safety of the structure. There are, however, new and lighter metals and other improvements in view that will further reduce the structural weight of an airplane.

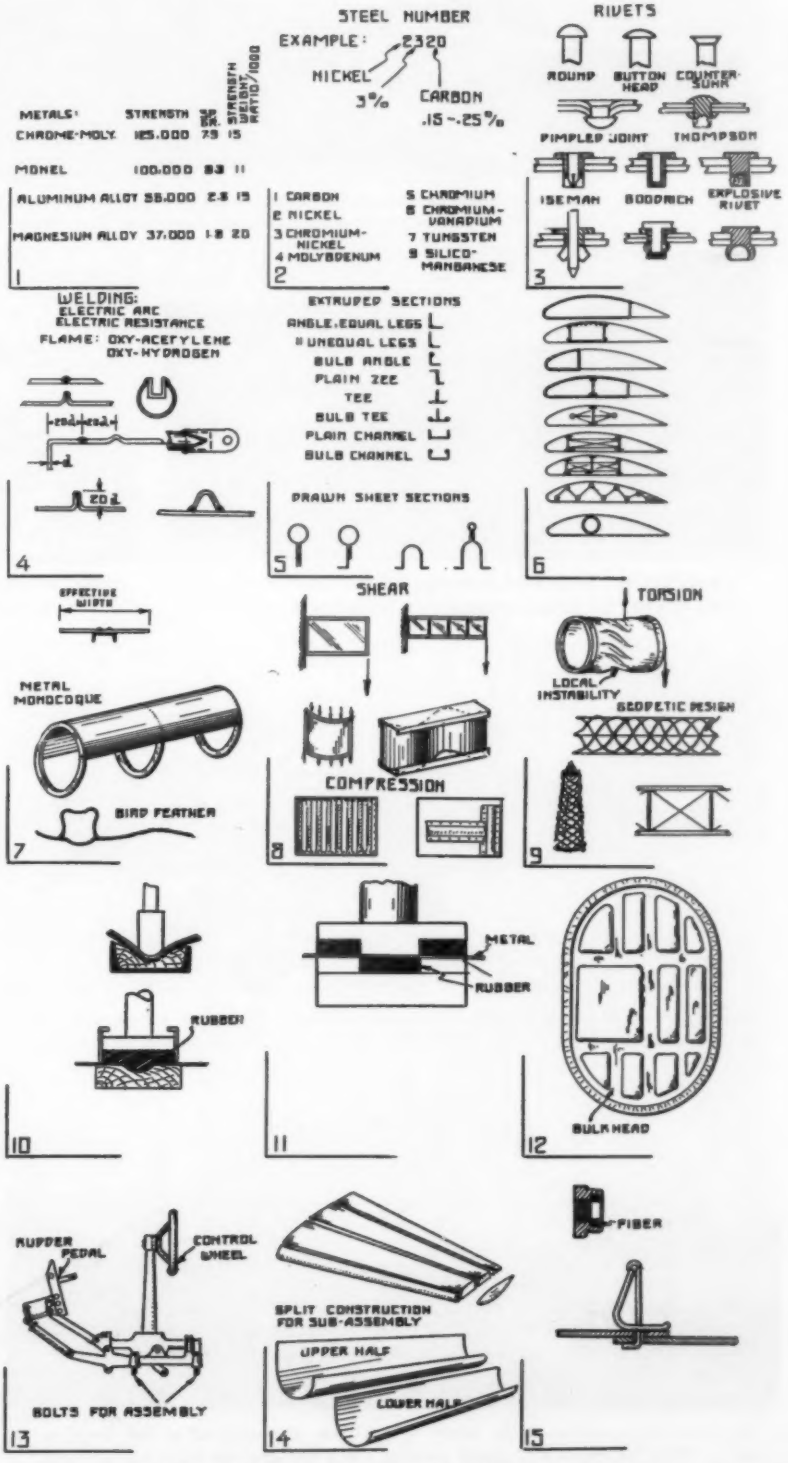
The specifications of a few metals used in airplane design are tabulated in Section 1. Their approximate merit figures of strength-weight ratio is indicative of their adaptability in airplane designs. Until lately, however, wood structures could be built lighter and cheaper.

Steel and its alloys were the first metals used in airplane designs; they are indicated by S. A. E. numbers. In Section 2 the meaning of the corresponding figures is given. The first figure gives the kind of metal present, according to the table appended; the second figure gives the percentage of that metal and the last two figures the carbon contents in "points" or in one-hundredths of one per cent.

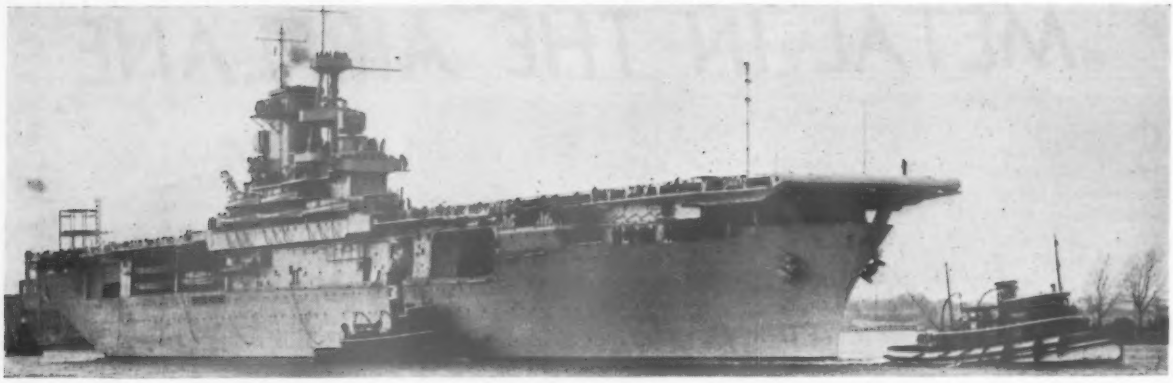
There are various ways to connect metal parts or members to form a structure. razing, bolting, welding and riveting are the accepted means. Easy to estimate and, at the same time very economical, is riveting by hand or by machine. A few rivet heads and cross section of rivets are sketched in Section 3.

Generally, two workers are required for riveting. In order to reduce the cost of riveting, rivets now are available that can be formed from the side from which they are placed into the holes,

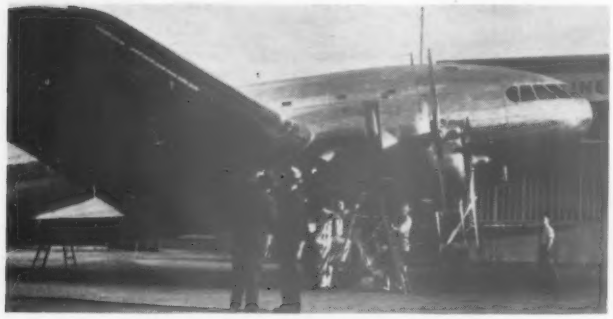
(*Continued on page* 78)



Author's sketches above illustrate salient points in his article.



Newest U. S. Navy aircraft carrier is $20,737,000 U. S. S. Wasp just launched. Next to Ranger, Wasp is smallest plane carrier (14,700 tons). Officially designated CV-7, Wasp is sixth Navy vessel so named.



Latest Boeing "Stratoliner", recently delivered to Pan American Airways, has been equipped with built-in wing tip slots.

Novel attention-compeller is this experimental airplane built into New Castle, Del., restaurant roof to resemble a crackup.

Newest trainer to be announced is this Vultee "Valiant" powered with a 450 h.p. engine. Top speed is 170 m.p.h.; cruising, 143; landing, 54. Ceiling is 21,000 feet.

HAVE YOU SEEN ?

This experimental version of the famed Ryan ST was photographed at San Diego recently. While the standard ST comes powered with a Menasco, this has a Warner radial.

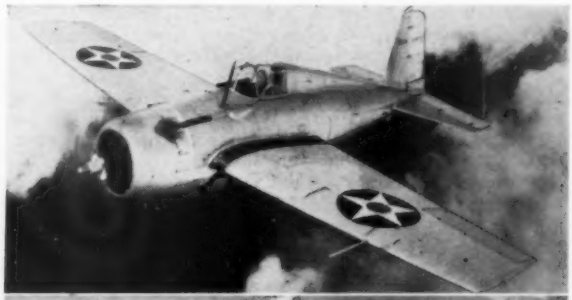
One of the first fuel-injection motors is on this Continental-powered Aeronca.

About to be placed on the market is this Aeronca tandem trainer. Engines can be 50 or 65 h.p. Rear seat is raised for visibility. Top speed (65 h.p.) is 100 m.p.h., cruising, 90; stalling, 35; range 250 miles.

Canadian-designed and built primary trainer is this Maple Leaf Trainer II. Engine is 145 h.p. Warner, top speed is 120 m.p.h., cruising 101 and its range is 346 miles. Ship carries a gross load of 1,865 lbs.

North American NA-35 is a primary trainer designed for mass production. The Allies may buy many. Engine is 150 h.p. Menasco.

University of Wyoming C. A. A. group devised cold-weather starting aid. Stove pipe in form of Y is attached to auto exhaust.



Two pictures directly above are of Navy's new Grumman XF4F-3 fighter. Export version of this ship may be sold to Allies.

THE MODEL DEPARTMENT

by PAUL W. LINDBERG
Model Editor and Designer

★

Model builders can save themselves money as well as add to their enjoyment of a new handicraft by making their own rubber tires for airplanes or automobiles.

THIS article is for those who wish to make their own model airplane or miniature auto tires. By this method, one can design any size or shape tire desired.

Shown in the accompanying drawing are two types of tires. They will be explained step by step:

Figure A

This tire seems to be the most widely used at present. Having obtained some close grain wood from which you make the pattern, turn two halves as shown, making sure they are sanded to a smooth finish. After the halves have been turned to their proper shape, cement them together. If a noticeable seam is left around the center of the wooden pattern it should be sanded and filed until it appears to have been turned from one solid piece.

There are three methods of applying the liquid latex rubber to the pattern. The first is by submerging the pattern into a cup of liquid latex and revolving it so that a thin coat of rubber is applied evenly over the entire pattern. Remove the pattern from cup and continue to revolve it so as to prevent any unevenness of the rubber deposit. This operation may be repeated at 15 to 20 intervals until the proper thickness is had. One thirty-second inch thickness in the wall is recommended for three to four-in. diameter tires. However, this thickness need not be exact. In order to hasten maturing, rubber may be cured on the pattern inside an ordinary baking oven at mild heat. Severe heat will damage the strength of the rubber.

The second and third methods involve spraying or brushing the rubber on. The brush is less preferable, as the outer finish cannot be kept as smooth as in the other two methods shown.

It is advisable to let the rubber cure on the mould for two or three days to obtain best results. They may be removed sooner but a decided shrinkage will take place, although this is not overly important as they can be inflated to their proper diameter. Dust the tire with ordinary talcum powder as soon as it is removed from the pattern; this prevents the rubber from sticking to itself.

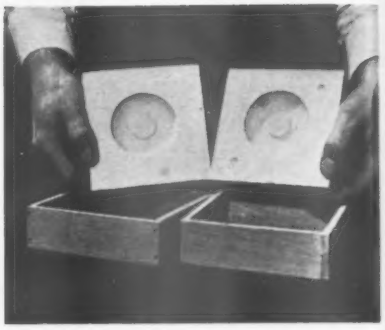
In order to remove the tire from the pattern it is necessary to cut a small circular section from the tire at the hub on either side. To make the tire leak-proof, regular tire patching cement is applied to the flaps which, in turn, are clamped tight together by the two pieces of hard-wood hubs. (See cut section of drawing.)

Figure B

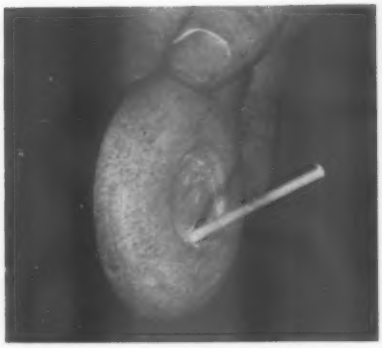
This shows a tire of streamlined section and a method of making the unique hub. This type of tire is made in a plaster of Paris mould divided in halves. The method shown is the absorption type. A number of coats of rubber are applied by successively pouring in and out the rubber latex in order to gain the proper thickness. It is advisable to dry out the plaster mould so that when the rubber is poured in, the plaster of Paris will absorb the water which is part of the liquid rubber and leave only the rubber deposit on the walls of the mould. Excess liquid rubber may be poured out when the proper thickness is had. The valve illustrated is a tubular piece of rubber which is an integral part of the tire. Be sure the 1/32-inch O. D. piano wire insert is covered with a coat of paint so that the metal in the wire will not damage the rubber.

Liquid latex may be purchased in pure white or black, although tires can be made any color that is desired by adding ordinary water colors. Remember: the longer the tire is allowed to cure, the better the product will be. If unable to buy liquid rubber latex locally, we will recommend a source of supply. Send a return self-addressed postal card.

END



The mold is made of wood and is built in two halves. These are cemented together.

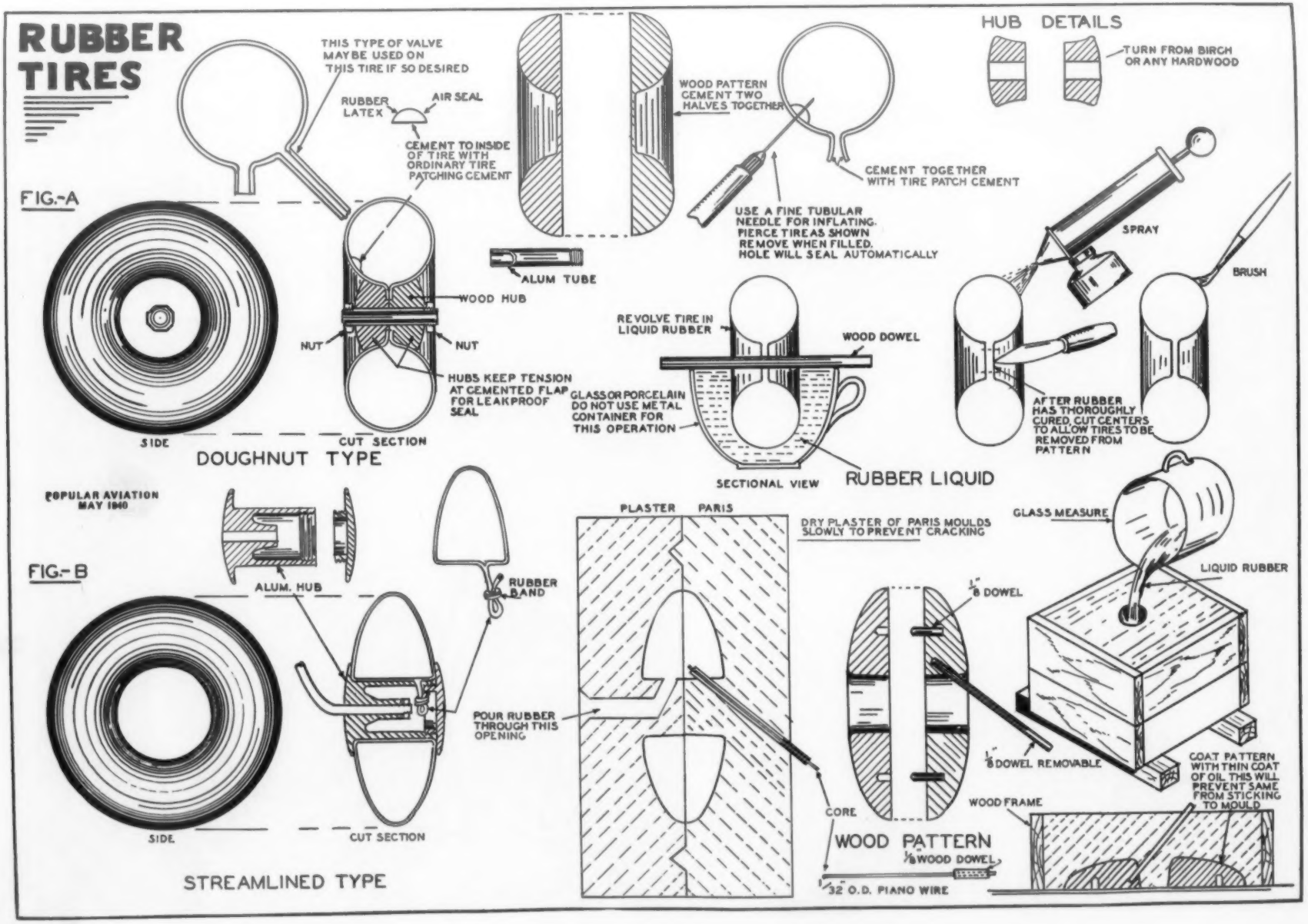


This is one side of the wooden pattern, showing dowel for shaping inflation tube.

The pattern is revolved over an ordinary teacup which contains the liquid rubber.

After two or three days of curing in the mold, the finished tire looks like this.

RUBBER TIRES


THIS TYPE OF VALVE MAYBE USED ON THIS TIRE IF SO DESIRED
RUBBER LATEX
AIR SEAL
CEMENT TO INSIDE OF TIRE WITH ORDINARY TIRE PATCHING CEMENT
FIG.-A
WOOD HUB
NUT
NUT
HUBS KEEP TENSION AT CEMENTED FLAP FOR LEAKPROOF SEAL
SIDE
CUT SECTION
DOUGHNUT TYPE
ALUM TUBE
WOOD PATTERN CEMENT TWO HALVES TOGETHER
CEMENT TOGETHER WITH TIRE PATCH CEMENT
USE A FINE TUBULAR NEEDLE FOR INFLATING. PIERCE TIRE AS SHOWN REMOVE WHEN FILLED. HOLE WILL SEAL AUTOMATICALLY
HUB DETAILS
TURN FROM BIRCH OR ANY HARDWOOD
REVOLVE TIRE IN LIQUID RUBBER
WOOD DOWEL
GLASS OR PORCELAIN DO NOT USE METAL CONTAINER FOR THIS OPERATION
SECTIONAL VIEW
RUBBER LIQUID
SPRAY
BRUSH
AFTER RUBBER HAS THOROUGHLY CURED, CUT CENTERS TO ALLOW TIRES TO BE REMOVED FROM PATTERN
POPULAR AVIATION MAY 1940
FIG.-B
ALUM. HUB
RUBBER BAND
POUR RUBBER THROUGH THIS OPENING
SIDE
CUT SECTION
STREAMLINED TYPE
PLASTER PARIS
DRY PLASTER OF PARIS MOULDS SLOWLY TO PREVENT CRACKING
GLASS MEASURE
LIQUID RUBBER
1/8" DOWEL
1/8" DOWEL REMOVABLE
COAT PATTERN WITH THIN COAT OF OIL. THIS WILL PREVENT SAME FROM STICKING TO MOULD
WOOD FRAME
CORE
WOOD PATTERN
1/8" WOOD DOWEL
1/32" O.D. PIANO WIRE

The War's Forgotten Men

(*Continued from page 20*)

pilot and not the gunner will receive the first protection. The weight of the hydraulic turret and the vulnerability of its complicated plumbing system also are cited as disadvantages.

Air gunnery goes back to the days before the First World War and to the Balkan corner of the world—where trouble is expected this spring, just as it has been expected there almost every spring for some hundreds of years. The year 1912 had one of those springs when trouble really did come: the Balkan powers fell first on the Turks and then on each other. A group of wild spirits descended on the Balkans that summer to find out if there really could be any such thing as military aviation. They carried revolvers with them when they went aloft but, at first, not to shoot at each other. They were protection against enemy infantrymen; if the planes of that day ever did get so far as the enemy lines, it was a better than even bet they would not get back again. Then one day somebody aloft shot at somebody else aloft with that revolver. The war in the air was on.

Came World War I and observers whose arms were at first rifles, then ring-mounted machine guns. Then Eugene Gilbert and Roland Garros, a couple of Frenchmen who probably did not realize the risk they were taking, mounted fixed guns firing forward through the propeller disc, Garros refined that by putting metal deflector plates on his propeller blades; even then it was risky business. They astounded and shot down more than half a dozen Jerries who never dreamed bullets could come out of the propeller end of an airplane. One day Garros' engine quit on him and he was forced down inside the German lines and his plane captured before he could destroy it. The late genius, Tony Fokker, took a look at the invitation of the German high command and two days later had completed the first synchronized machine gun—fired by the propeller shaft and timed to miss the whirling blades. The fixed gun fighter comes from that. The ring mounting is the father of the hydraulic turret and all of the other modern bomber defensive arrangements.

A few years ago the French worked out the theory of the multiplace de combat (which is not the multiplace fighter) as the completely defended bomber. It had no blind spots. A machine gun defended every possible approach. But therein lay the rub. Having some fire power everywhere, it had enough fire power nowhere. No bomber can carry enough guns to have high fire power everywhere. The war has shown, and smart staff officers have known for some years, that concentrated volume of fire is what wins wars aloft as well as on sea and on land. The multiplace de combat, therefore, was dropped.

The bomber today has blind spots, lots of them. But where it is not blind it has tremendous hitting power—and the British turret-defended bomber has most of all. Close formation flying, group tactics and squadron fire control with all planes covering each other's weaknesses, now are relied on for eliminating the blind spots. This development is one of the factors behind the British move to recruit officer gunners; they command all the guns in a given squadron. The pilot's job is merely to fly on as he is told by the squadron leader, who works closely with the fire control officer. The pilot of a plane on a group mission is not necessarily the commander of the gunners in his own ship.

The British are highly pleased with the performance of their turret—so much so that two single-engined two-seater fighters, the Boulton-Paul *Defiant* and the Blackburn *Roc* (both built by Boulton-Paul, the firm which is largely responsible for the development of the hydraulic turret) have been designed to take advantage of it. The *Defiant* is *Merlin*-powered; the *Roc* Bristol *Mercury*-powered and smaller, as it is designed for operation from aircraft carriers. Each has only light fixed wing gun armament. The punch—four machine guns in each case—is concentrated in an amidship turret. These planes will attack by flying alongside and opening up with a broadside raking their target fore and aft instead of the tail-on attack of the usual fighter. Single-engined two-seat fighters were abandoned a few years ago in the race for speed, so it is interesting to see how these two unusual ships and their unusual method of use work out. Though quite a few have already been produced, none had yet been in action at the time of writing.

The hydraulic turret and all the other alternative bomber defense arrangements, however, appear to be headed for difficulties. The coming of armor plate will make the rifle calibre machine gun almost useless aloft, as nothing less than a .50 calibre heavy machine gun firing armor-piercing, explosive bullets then will be effective. Yet weight and structural limitations will make mounting guns larger than rifle calibre with any decent amount of ammunition extremely difficult. The recoil problem becomes important with these larger guns. It is only in the last few months, however, that European engineers have begun to pay any attention at all to this.

But regardless of what the future may bring, turret guns are speaking loudly today on the western front and, through them, the man at the trigger. He is making himself felt by the enemy, even if not yet in the public prints or in the lore of aviation.

END

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Revolution Over . . .

(*Continued from page 17*)

headquarters. The planes of the O-47 type are better adapted for work over in enemy territory, from the firing line to as far back as one to several hundred miles where general, rather than detailed, observation is desired and where defense against ground fire is had by speed, and against pursuit aviation by speed *and* defensive machine gun fire from the observation plane itself.

It is significant that the changes in observation plane characteristics were decided upon before the Germans made their historic advance into Poland. We can assume that our Army's doughboys and artillerymen sat in lengthy session with the Air Corps while characteristic requirements were being drawn up for these batches of airplanes. Readers might revise any preconceived ideas that these foot sloggers and cannon shooters don't know what it's all about when it comes to certain things in the aeronautical line. Where the picture is not the Big Picture of Air Power but is one of aerial service and close support for these groundlings, the latter have plenty of savvy.

There still remain a few generals, fewer potential ones and still fewer future wartime division and corps commanders who use or would like to use observation aviation to do what attack (light bombardment) aviation is supposed to, in addition to observation work. The same applies to those who would use up all the observation planes allotted to them the first day they got them. The missionary work of the Air Corps is bearing fruit. The groundlings are quite convinced that there never will be enough air service for their use; that if they fritter it away too early in a fight or even before they come to grips with the enemy they will be partially blinded. They fear blindness, not only because they cannot see what the enemy is doing or even what some of their own troops are doing but because blindness in battle has a psychological effect producing uncertainty, hesitation and fear of the unknown, finally resulting in everyone questioning the ability of his superiors and subordinates. It is exactly like flying blind, without radio aids, in mountainous country at a lower altitude than the mountain peaks, with other airplanes in the vicinity doing the same thing at the same time.

The selection of the lightplane for observation purposes does not mean the elimination of the heavier types. As previously described, these latter types have characteristics necessary for successful work back in enemy territory and over heavy concentrations of enemy troops. In the National Guard each of the squadrons—19 at present, 21 by July 1st and a total of 29 during the fiscal year 1941—will have one basic combat, 10 observation and three short range lightplanes. Regular Army squadrons will also have several of these small liaison planes.

A description of how ground forces expect to go into battle might be in order. As several divisions in a corps and several corps in a field army advance, they literally feel their way toward the enemy who is doing about the same thing. The stock type observation plane, of medium range, seeks out the main concentration areas of the enemy so that the ground commander knows where to steer his large forces. Columns advance, in truck or afoot, and are preceded by scout and armored cars. The light liaison planes, throttled way back, scout over the routes to be taken by these scouting vehicles and keep the reconnaissance detachment commanders informed on the condition of the roads, the presence of road traps, blown bridges, ambushes or enemy scouting detachments or vehicles. They relay messages and maps which cannot readily be sent by radio or wire, between the division commanders and their scouts. The same service is given between the advance guard and column commanders and the division headquarters. With low power and *safe* slow speed, easy maneuverability and the ability to utilize small, uneven fields for landings and take-offs, the lightplanes are admirably suited for such work. Given a safe stalling speed of less than 40 m.p.h. with full load of crew, gas and radio, the observer can observe and absorb much detail missed by one who must scoot by about 30-35 m.p.h. faster.

Contact is eventually made with the enemy's armed forces. Battles begin to shape up. The lightplane still stays over its own side. Hovering low at slow speed over the enemy's riflemen and machine gunners would be fatal. In fact, it takes considerable education and discipline to prevent friendly (?) troops from firing at their own planes when they make too tempting a target. Planes of the heavier types work over the enemy areas, most of the time over 3,500 feet altitude—the pilots pouring the soup to them whenever lower work becomes necessary. Of course, where a *detailed* search is required over any enemy area and slow speed operation is called for, the lightplane can make it, but at altitudes well above effective rifle range.

The battles get noisy, bloody and, like most battles, well balled up. The artillery begins to shoot. Division headquarters is moved up to within two miles of the front. The observation squadron still is based back at the group airdrome, 40-50 miles back and possibly farther. The Old Man orders an advanced landing field to be established in the vicinity of division headquarters. It is too much to hope that any but the lightest, slowest planes can land and take off at any cleared space which might pass as a field. The observers in the O-47s must communicate with division headquarters by radio or by drop and pick-up messages, or by wire or messenger from the base airdrome. The lightplanes, however, may drop in at the rough clearing near the headquarters. The division commander and members of his staff want information. The hot dope from the aerial observer, delivered by him personally; dope often developed by G-2 or an assistant who will question the observer and his pilot to bring out items of information concerning the front line action which the flyers might have believed too insignificant to report but which may mean much when analyzed and matched up with other intelligence. War friction often stresses the grilling by the Intelligence of a luckless prisoner to bring out information concerning the prisoner's outfit and conditions behind the lines. But we may expect to find intensive questioning by Intelligence of any of his own aerial observers who have made a trip over the lines.

Another revolutionary idea also is brewing over our front lines—that of sending out *unarmed* airplanes. A preview of a presumably accurately drawn artist's conception of the Stinson O-49 shows it to be weaponless. It is obvious that it must be so if it is to remain a lightplane, for gun, ammunition, gun mount and accessories are heavy. Will commanders send out such planes when enemy pursuit aviation is active or even in evidence? Probably they will, at the same time providing an anti-aircraft machine gun detachment for the unarmed lightplanes' protection. That is, along one portion of the lines or back at the headquarters the same A. A. machine gunners who are to drive off persistent enemy observation planes will fire at

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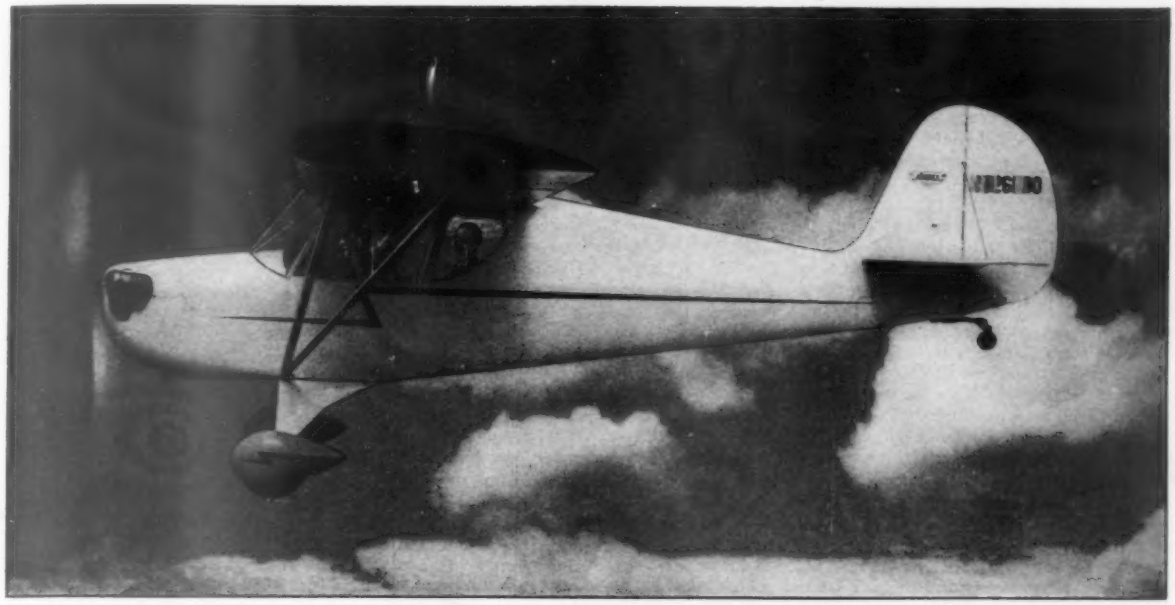

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enemy pursuit planes which have chased the unarmed lightplanes into that protected area. Operating at low altitudes, making a poor target for pursuit aviation, it is not likely that these planes will often be jumped but if they are they can always high-tail to the protected area and maneuver to spoil the aim of th pursuiter—maneuver being better protection than landing. The proposition of sending out unarmed airplanes, therefore, is not actually as heartless as some airmen might believe.

Where does the observation balloon come into the picture? Best suited for the adjustment of artillery fire the balloons are excellent for moderately stabilized situations and for the larger calibre gunfire. Where the situation is a moving one with gun batteries shifting their position frequently, or where the ranges are short with targets easily seen from the front lines, the little lightplanes should be invaluable. Balloons, in our Army at least, should not be as vulnerable to aerial attack as during the World War, for we have a well-developed system of helium production; also a monopoly on that non-burning but buoyant gas.

During the spring maneuvers of a number of divisions in the south, there may be two balloon squadrons participating: the one from Fort Bragg, N. C., with the eastern forces and the one from Fort Sill, Okla., with the westerners. They will probably be used with the corps artillery. Unfortunately there will be few if any lightplanes in the regular Army squadrons participating in these maneuvers, as they will not be in production in large quantities. In August, however, a number of National Guard divisions with the squadrons will participate in maneuvers with the regulars and it is hoped that the liaison lightplanes will be present in sufficient quantity to put them to a practical tactical test.

The autogiro may be on the way out. Some say there is little it can do that the lightplane can't do, and do more cheaply and safely. Pending decision of the War Department in the matter, it would be unfair to be too sure about that for the windmills have been put to severe and lengthy tests. The liaison lightplanes have not, except in the German army which first fostered the Fieseler *Storch*, a demonstration of which fired the imagination and ambition of our fighting folk.

END

Fish Fly

(*Continued from page* 50)

keting and competition in the city, is getting trout the right size. Krogers like fish weighing about four pounds apiece. Hadden doesn't try to get fish directly from the fishermen, a process which would take too much time. Instead he buys them from a Sturgeon Bay fish dealer who handles the time-consuming job of collecting fish from individual fishermen each morning. Hadden carried both whitefish and lake trout at first, but now his average cargo is composed almost entirely of trout.

The idea of a plane carrying fish naturally carries to the layman a rather unattractive mental picture of a lot of dead fish piled one on top of the other all together inside an airplane, with the unfortunate pilot pressed in somehow in front of them. Actually, the whole effect is decidedly neat. The plane, originally used for passengers, has been remodeled for freight use. The fish are packed in lots of about 100 pounds each, in metal containers which are fastened one on top of the other in the big compartment behind the pilot. The containers are securely fastened. Even a carload of dead fish, once loose, would be fatal. An ingenious system of drains takes care of any surplus water from the cargo.

While flying fish is purely a business proposition to Hadden, it also is giving aviation some much-needed bolstering in Door County. Everyone in the county knows of the "fish pilot" and many have traveled long distances to watch the big Stinson land, swallow its unique load and take off for St. Louis. Some who come to see the "curiosity" remain to become aviation enthusiasts or at least enough so to talk aviation to their neighbors. And when people start talking aviation, the battle's half won. Meanwhile, Jack Hadden goes on building up what is undoubtedly one of the middlewest's most unique business ventures.

END

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Butane Bus

(*Continued from page* 25)

"We have greater flexibility of engine control, due to efficient fire propagation after the fuel has passed through the mixing mechanism," he said.

Recently, to prove the efficiency of the fuel, he climbed to 14,000 feet in the monoplane, put the nose down in a dive and held the throttle well back until he was at 500 feet. Then he shoved the throttle wide open and the motor caught immediately in spite of the chilling dive through winter air.

Beilgard's tests, he claims, have shown that cruising radius can be almost doubled, due to the lightness and greater efficiency of the fuel. Another claim he makes is that oil consumption is decreased because the gas is dry and does not blow by to dilute crankcase lubricant.

"In addition to this," he says, "wear is reduced because there are no impurities to get into the oil."

He points out that cylinder temperatures can be more uniformly controlled because of more efficient combustion of fuel. The fuel turns into power rather than being dissipated into heat. "Furthermore," he declares, "fuel pressure cannot drop because the fuel maintains its own pressure in its natural condition. Pumps, strainers, floats and other complicated equipment are eliminated. Carbon formation is reduced because of the efficient combustion of the fuel.

"The fuel is especially valuable in combat flying. The feed system is not affected by acrobatics. There is no carburetor float. The mixing mechanism operates perfectly in any position. Efficient operation is assured whether it is in updraft, downdraft or horizontal position. Obviously, there is no added weight for carburetion. In fact, weight is cut down as well as operation is simplified. The mechanism is much lighter than the conventional carburetor."

Butane and propane, the chief ingredients of the liquefied gas fuel, are end products in the manufacture of gasoline. They are the "higher gasses," two among several. Butane gas has been used in the operation of tractors and on some other motors. But this is the first time, Beilgard is sure, that the gasses in any form have propelled airplanes. He says that the octane rating of his mixture is about 120.

"The amazing thing about the fuel," he says, "is that it burns so slowly within the cylinder heads. It has the effect of steam. There is less vibration in the Lambert with the gas than there is with ordinary gasoline."

In discussing his tank problem, Beilgard says he feels confident that a suitable ball tank can be constructed. This tank, of high tensile steel, would have a tendency to deflect bullets in military usage. It would have the approximate weight of the conventional gasoline tank. A ball 15 inches in diameter would contain approximately 20 gallons of fuel, giving his present ship a cruising range of about 600 miles at his present cruising speed of 120 m.p.h.

Beilgard is no neophyte who has stumbled into something accidentally. His experiments with gas have covered a period of more than 10 years. He has been flying for 30 years. He was a roustabout in the Indiana sand dunes camp of Octave Chanute during the glider days of 1901-1902.

He was born in Milwaukee July 8, 1889. He attended the University of Wisconsin and took post graduate work at the Massachusetts Institute of Technology. He was attached to the Chanute camp in the course of two summers and there met the Wright brothers, who believed that man could fly in motor-propelled heavier-than-air ships, and Glenn Curtiss, who was toying with the same idea.

He entered the garage and motor sales business at Lake Forest, Ill., to get enough money to continue experiments which he started with huge kites, some with pull of between 60 and 80 pounds. He was with Curtiss in 1910 and 1911. During this period, in his spare time, he built his own motor and his own airplane—a job which resembled both the Bleriot and Antoinette monoplanes.

"You might say it contained the best features of each," he says.

He taxied it up and down the field at Lake Forest until other pilots began to kid him about his tendency to stay on the ground. Then one day he took off, circled the field at approximately 300 feet and made a perfect landing. And a pilot was born.

His career since that time has been dotted with airplane construction, barnstorming, racing plane design, motor design and building and practically every other phase of aerodynamics and aeronautics. In 1930 he conducted his first experiments with gas-propelled motors. He went into it in a big way, creating a 500 h.p. job which was to be operated on butane. In size, it was not as large as the 225-h.p. radial which was then considered the last word. Encouraged by backers, he ran it successfully for 20 hours. However, in 1930, there was little enthusiasm for this kind of experimentation and little commercial market for 500-h.p. motors. In fact, the ship in which the motor was to have been installed succumbed to the economic stress of the period.

He abandoned the work to turn his attention to racing planes. Then, four years ago, he decided to design another gas motor, developing about 125 h.p., to power a ship of his own construction. His first plan was to build a plane to seat four, sell around $4,000, cruise about 120 m.p.h. and land at about 20 m.p.h. with slots.

He first evolved an experimental two-place job with slots. Then he discovered not long ago that the Lambert would operate on the new formula mix, abandoned gasoline, got an "X" on the ship and put in his present eight-gallon gas container. Several gasoline companies were not interested in supplying the gas—

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in fact, there's a state law in California prohibiting its use in automobiles on public highways, Beilgard says—but Shell was interested.

"The ship," he adds, "has flown perfectly ever since."

What of the future of the gas? Beilgard isn't interested, at the moment, in the construction of a motor with a 12 to 1 compression ratio for private planes—a thing he believes will come ultimately. His first concern is in converting large motors which he will pick up for freight use and the construction of huge cargo planes.

"The chances are," he says, "with the present rate of air transportation development in Central and South America and in Alaska, roads won't be built to any great extent and neither will railroads At the present time, 25 cents-a-gallon gasoline makes air transportation of cargo prohibitive. The profit or loss virtually lies in the cost of the fuel. If I can produce a five- or six-ton freighter powered by conventional motors which will use gas at less than four cents a gallon, freighting will become profitable. Furthermore, I have some rather radical ideas in regard to the construction of the freighters. One plan is to build the ships with removable fuselages. These fuselages can be loaded while separate from the airplane and then installed in a substantial framework. The plane will take off with the loaded fuselage, land at destination and leave it, picking up another to save time. In case of motor failure, the fuselage can be dropped from the air over uninhabited country if no reasonably good landing place is available and the plane can be landed much more safely without cargo."

However, this is looking into the future. Speaking for the present, less-than-four-cent fuel seems to be a practical thing as demonstrated by Beilgard. Which, gentlemen, is something!

END

Grocery Bombers

(*Continued from page* 38)

speed up control on hundreds of fires in Montana, Idaho, Washington, Oregon and California. Greatest advance has come since the grocery bombers fell heir to the big supply of discarded Army parachutes.

"What is good enough today isn't good enough tomorrow," sagely remarked one of the men at the Missoula, Mont., regional headquarters. This region, which probably deserves the No. 1 spot in using airplanes in forest protection, is investigating many ways in which planes may further contribute toward speedy fire suppression. That grocery bombers soon will be dropping prepared meals in jacketed containers, hot from big base kitchens, is one of the predictions one hears around the Missoula office. Such a development will add to the flexibility of field crews and remove complete dependence on central field camps.

Also intriguing the forward-looking human eagles of the forests is the idea that chemical bombs can be dropped on fires to smother them before they get out of the baby stage. Already the Forest Service, particularly in California, has done enough experimenting to conclude that some day chemical bombing may be a reality. The California region has its own plane, embodying many of its own ideas of what a forest plane should be like. Various chemicals, liquids and powders are being tested for their smothering ability.

This is the kind of bombing everyone can approve.

END

Birds of a Feather

(*Continued from page* 42)

Diego, is the motivating force of the far south contingent, who meet wherever the rest of the members do at the ends of their flights. Carlyle Thorpe, walnut grower of King City, Cal., always flies down to join up when a tour is ready to take off, and another Johnny-on-the-spot member is Jack Crawford, owner of Rancho Santa Ynez. In fact, he's been host to the membership on a couple of official flights.

Among the other prominent members are Earl Gilmore, head of the Gilmore Oil Company, flying a Lockheed "12"; Keith Scott, who lives in Los Angeles but uses his plane to commute to automotive and mining interests in Nevada as well as for pleasure; Major C. C. Moseley, one of the founders of Western Air Express and now in charge of the Army Air School at Grand Central Air Terminal; Henry King, motion picture director; Wilbur May, of the May Company, flying a Lockheed "12"; Tex Rankin, famous stunt flyer; Claude Ryan, of the Ryan Aeronautical Company; Charles Correll, the "Andy" of "Amos and Andy" and owner of a Stinson; Bill Skall, cameraman; and Brian Aherne, actor.

"We feel that it is advisable to continue as we are operating, with the small membership fee and no dues, so that anyone can join," Fairbanks says. "Somehow, if we tried to expand and put money into facilities, I'm afraid we'd lose a lot of the carefree, democratic spirit we have now.

"We hope that some time in the future more organizations like ours will spring up in all parts of the country because we feel that private pilots should be banded together to insist on our rights in the air and to help in the improvement of all private flying facilities. We have our hands full now, but I can see the value of a national group if only for the exchange of up-to-date information about fields, trips to take and facilities available and we would be willing to cooperate. In the meantime, we'll continue to welcome pilots who fly purely for the sport of it, regardless of age or equipment."

END

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I Learned About . . .

(*Continued from page 35*)

in our roaring "attacks."

Director Howard Hawks, the powder man, Nomis and I went over the scene in advance. Nomis and I were to make a series of power dives and chandelles over the field from predetermined angles. Each dive would bring us above a row of dynamite charges. The powder man, with the whole layout of the airdrome on the table before him, would press the proper buttons a fraction of a second *after* the planes passed. The effect would be just as if the planes had actually bombed the row of airplanes, the hangars or whatever it was we had just swooped over.

Our conference with Director Hawks developed into a two-hour argument, which Nomis and I lost. Hawks had picked for a powder man a technican whom we did not know. Nomis and I had nothing against the man except that we had not worked with him before. We were afraid he might become excited at a critical moment. Our candidate for the powder table job was Harry Reynolds, an engineer working on this picture in charge of all flying and field equipment.

Here were my reasons for putting up an argument: I entered the Army Air Corps with 700 hours to my credit and completed the full courses at both Brooks and Kelly Fields. I had high respect for military training in anything connected with flying or the handling of explosives. Nomis felt the same way about it. Reynolds was a man with military training—but we lost the argument.

We were flying two new *Speedwing* Travel Airs painted to resemble British pursuit ships and mounted with dummy machine guns. We took off after the charges all were planted and circled out of camera range at about 5,000 feet until we received the signal to start diving.

The airport was built just under the brow of a low hill. Our first dive was to take us just behind the hill, with our pull-out timed so we could appear suddenly over the crest in a "surprise attack." We were to come roaring across a small hangar and "bomb" a row of planes on the line in front of it.

Nomis led the attack. I came close behind and a little to one side in a standard two-plane formation. We came over the hangar less than 30 feet high at about 250 m.p.h. The explosives "expert" set off his first blast behind Nomis —right in my face!

A Jenny wing crumpled against my landing gear. A strut shot up and tangled with the propeller. Bits of debris, rocks and chunks of wrecked airplane ripped through the wings and fuselage. The concussion handed me a "blackout" in which my last instinctive act was to haul back on the stick.

"Get altitude . . . get altitude so you can bail out . . . get altitude!" my subconscious mind must have flashed its message to my paralyzed hands and feet on the controls.

I recovered consciousness in a full power stall at 1,700 feet with the motor vibrating so badly from the bent propeller that it threatened to shake itself loose from the plane. Dazedly I leveled off, eased back on the throttle and flipped the catch on my safety belt to free myself for a jump.

As my mind cleared I gave myself an instant for a lightning estimate of my chances for saving the ship. The wings are in shreds. I look back at the tail surfaces. Miraculously, they are intact. The ailerons, now. Damaged, but there's enough surface left for control if . . . yes, a kick at the rudder and a joggle of the stick show the control wires all are still connected.

I decided then to try for a landing and shoved the nose forward. I might make it, I thought, if the landing gear is still there. Trying to hold the ship in a flat glide revealed to me that most of my lifting surface was gone . . . I realized that I was in a sharp dive. Then it dawned upon me that I hadn't climbed to 1,700 feet after the explosion—not with most of my wings gone.

I had been blown up there!

Desperately I tried to kill my speed, then twice as desperately nosed down to pick it up again. If I slowed the plane any further I was certain to spin to the ground—I could *feel* the ship nearing the "falling off" point! Those tattered wings, from which new shreds of fabric were tearing loose, just wouldn't hold me up. But by now I was too low to jump. I *had* to land. . . .

Ahead of me was a wire fence and beyond that part of the runway of the "German" airdrome. I saw that if I kicked enough rudder to angle safely over the fence, I would have only a few hundred feet of runway left—and at the end waited the flimsy hangars—a sure bet for a nasty fire. I didn't dare risk a turn to a more favorable spot. Grimly I settled deeper into my seat, lifted my goggles up from my eyes and waited for the crash.

Leveled out over the fence and groping for the ground, the airspeed showed more than 100 m.p.h. The wheels hit and the plant lurched drunkenly. The landing gear *was* damaged! I fought for control as the hangars rush at me. Gingerly I felt for the brakes. They held. I breathed a prayer of thanksgiving as I brought the crippled plane to a stop with a scant 20 feet to spare.

First to reach me were Hawks and the "expert."

"Are you hurt?" they chorused. I could only shake my head.

The director tottered around the corner of the hangar and was violently ill. The powder man went back to his table. Nomis, you see, was playing an aerial Pagliacci—finishing out the scene single-handed.

Two weeks later we moved to another location. The powder man and his son drove a truck load of explosives to the new field. I flew one of the ships over. Just as I landed I heard a terrific explosion. The truck had gone up in a sheet of flame. They found the powder man and his son 150 feet away, bruised and burned. I walked over.

"Are you hurt?" I asked.

END

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Mr. Smith

(*Continued from page* 54)

was afraid to talk loud on account of the 100 octane gasoline."

He was being shaved in the studio Tuesday morning, having come back via TWA, when he got his call to be on the set. He still claims he only had time for the barber to shave the side of his face which would face the camera.

His latest thrill is the purchase of a Stinson "105". He got interested in it while flying Smallwood's job. He placed his order in December for a late '39 with a second gas tank big enough to give him a 700 mile cruising range and a special paint job. Came time for delivery. Jim was busy getting ready to make "Mortal Storm" with Miss Sullavan and Robert Young. He couldn't get back to Wayne County, Mich. So he sent Smallwood, promising to meet him at Kansas City.

Smallwood got off in —23° of weather. He flew about one hundred miles, found that no motor could take it without baffles. So he turned back, had the baffles installed and hopped to Kansas City, where it was only about 11° below zero. The field was banked with snow. Jim met him in Kansas City, where he'd been waiting for a couple of days.

"I guess it's happened to everybody," Jim says. "The boys at the field were swell. They all turned out in spite of the weather and we all shook hands and I thanked them and they told me what a nice guy I was and we did it all over again. I took the ship down the field and never got over 20 m.p.h. on account of the snow.

"I got to the far end and there was a little hangar there. You know how a fellow feels at a time like that. I just couldn't go back and say to those boys who had told me goodbye, 'Well, here I am again.' So we got the ship into a corner of the little hangar and we beat it away and stayed all night in a small hotel. The next morning we sneaked out real early and took off from a taxi runway.

"Somehow, I got her up to Wichita. The snow grabbed the wheels away, way down at the south end of that field, which means practically back to Kansas City. The wind was blowing 35 m.p.h. We jockeyed the job up to the administration building. I got close to a stove. Pretty soon I smelled something burning. So did other people. I started an investigation and it turned out to be me. I was too numb to know.

"I'd navigated so well coming into Wichita that I'd missed it by only 60 miles. I decided when we took off from Wichita between two hangars with the flaps down that I'd do better from there on out.

"We were closed in at Amarillo. We waited two hours. Then we made Tucumcari and were down there three days, not counting one false start when the ceiling moved down to 50 feet. The last day we made Albuquerque. From Albuquerque to Los Angeles we had grand weather and a tail wind."

Jim left Albuquerque at 7:20 a. m. and hit Burbank at 3:45 p. m., with stops at Winslow and Kingman. He computed his time for 2,300 miles, not counting his "navigation detours," at 23 hours and 40 minutes, which is about 98 m.p.h. His gas and oil cost was $32.23 from Detroit.

"Trouble with aviation," Jim says, "is that you're always branching out. Now, you take me. When I left Kansas City, I was the happiest guy in the world. I spent at least an hour after the ship came in just looking at it. Now I'm getting gadgety. First I have to have a sensitive altimeter. Now I'm looking for a turn and bank. And I feel one-way radio, maybe two-way, coming on. That's the way it goes. A guy is never satisfied."

Jim liked the tough time getting from Kansas City to the coast. Just as he liked the all-night flight in the Lockheed with Jimmy Mattern, the flight during which he dropped out his non-flying model and that first $15 trip when the profits of an entire winter were washed out in ten minutes of sitting on a leading edge.

"I guess I'll go right on flying, as long as I'm able to fly," he says. "I can't seem to help myself."

END

Ersatz Does It

(*Continued from page* 14)

may be produced by the Fischer-Tropsch process and that, by synthesis, gases rich in olefines may be produced which can be polymerized into gasoline of high octane value while vast quantities of methane can be produced by hydrogenation of coal which in turn may be converted into conversion products likewise polymerized.

Petroleum will share with food supplies the primary importance as a deciding factor in the economic blockade which is expected to determine which side will win the war. Nevertheless, let me warn against undue optimism of Germany's early defeat through oil starvation, for World War experience has clearly shown that non-military consumption of essential raw materials can be cut down to a tenth or less of peacetime demands—and Germany may be able to survive much longer than even the foregoing somewhat favorable data might indicate.

The writer is of the opinion that Dr. Gustav Egloff's much-publicized remark —"Not the guns of France or Great Britain or Poland, but the knocking of her airplane motors will toll the doom of Germany in this war"—was in all probability an over-statement founded on wishful thinking, and feels that more in accordance with known facts is Dr. Brooks' comment that Nazi war plans will not be hampered for lack of petroleum supplies for some time to come.

END

The Birdmen's Perch

Below are listed the balance of the solvers of the December problem. That is, all who sent in their solutions before the deadline we had to set in self-defense. In order to bar having to print a special Honor Roll next November for that one very welcome letter that always comes in eight months after publication from a fan in Johore, Pago Pago, or Tanganyika.

"Tattered Wing-Tips," Editor, The Birdmen's Perch, Room 3800, Gulf Bldg., Pittsburgh, Pa.

REPEAT PERFORMANCE

On February 15th the National Safety Council handed out its Certificates of Special Commendation for 1939.

Right up there, leading the parade in safety achievements, were three old friends of ours who will be hanging up this year's certificates next to the ones they won last year and in years previous.

The friends:

American Airlines, Inc.
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WHAT PRICE FRICTION?

The other day we read where 500 tons of weight, floated on oil, can be moved by only 1/650,000 of a horsepower. As to how many thousand horsepower would be required, if there were no oil, we shudder to guess.

But the fact is that without oil no plane would get off the ground. And without *good oil* no motor would keep running for more than a few minutes. For the strain put on oil by modern engines with their high-compression ratios and higher temperatures is such that inferior oils burn up . . . go to carbon and sludge in no time.

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OLD-ENOUGH-TO-KNOW-BETTER DEPT.

The combined ages of a pilot and his plane are 35 years.

When the pilot was twice as old as the plane is now, he was twice as old as the plane was then.

How old is the pilot and how old is the plane?

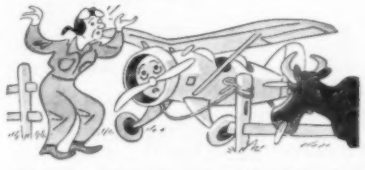
(Mail in your answer today to T.W.T. We'll shoot back the official by return mail.)

THIS MONTH'S WHOPPER!

Dear T.W.T :

Here is my contribution to This Month's Whopper. If it's true, then I'm a liar.

After barnstorming all last Summer, I checked my profits—or else—and decided to tie her to a fence to slowly rot away. Make more money that way.



Naturally when anyone retires they raise chickens or Hell. I took chickens (having done my Hell raisin' previously) and, to soothe my nasty disposition, a rattlesnake by name of Buzzie for a pet.

Now Buzzie was in the habit of slipping into the hen house to get himself an egg. Inside, one day, he ran onto an old doorknob. "Nice egg," says Buzzie. "Nice eating." So down it went.

When about halfway out through his favorite knothole in the door, he spied the other doorknob which had fallen off on that side.

"Well, guess I can stand one more," says Buzzie.

Now then we got something to think about. Buzzie with a knothole around his middle and him around a doorknob on each side the knothole. "Buzzie," says I, "this is going to take headwork. Digest 'em—long time. Break 'em—nope. Hurt Buzzie."

Two days Buzzie was in despair (also in the knothole); then it struck.

"Buzzie," says I, "your venom ain't got oomph." So I tore for the house, got a medicine dropper, filled it with a few drops of Gulf Aviation Gas out of my tank and shot it down Buzzie's throat.

Whang! Out the door he came—knothole and all. He coiled three times and took off East.

Noise! You shoulda heard his rattles. Their roar run half of Europe into their bomb shelters when he passed over.

O. A. Moritz

P. S.—Buzzie came gliding in just now. Says, "Make mine sparrow eggs. And Gulf Aviation Gas! Takin' no more chances."

Gulf Oil Corporation and Gulf Refining Company . . . makers of

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Metal Airplanes

(*Continued from page* 59)

thus eliminating "bucking" usually necessary.

Most interesting of them is the explosive rivet. It has a non-corrosive explosive mixture which is exploded by slightly heating the rivet head. It should be mentioned that single row riveting is about 60 per cent efficient; a triple row riveting gives 80 per cent efficiency.

A widely used method of joining metal members is welding, or fusing the metal by heat. This may be done by electric current or gas. The electric welding may be arc, spot, shot, roller, projection or flash-butt. Gas welding may be oxy-hydrogen or oxy-acetylene. Usually the metal at the fused joint does not have the high quality of the original metal. The deposited metal has the strength of a casting. The ever-present problem of heat distortion and residual stresses requires high quality of workmanship. In Section 4 a few welded joints are sketched. Also, the distance of the welded seam from an edge or corner should be placed to prevent warping. Shot welding, which uses part of the alternating current wave, has been successful in fusing stainless steel members without danger of corrosion.

Aluminum and its alloys, in the form of castings, forgings, extruded sections or sheets, are slowly replacing steel. The mechanical properties of the alloys depend upon the temper of the metal which is determined by the amount of strain hardening or cold working, given during fabrication. The maximum mechanical properties are produced by heat-treatment followed by proper aging. The strong alloys can be annealed after heat-treatment by holding them at a certain temperature, after which they should be very slowly cooled. Protective coating of sheets with pure aluminum (Alclad) or a chemical treating in acid dichromate bath are advantageous.

Regular extruded shapes and drawn sheet sections are shown in Section 5. The sheet sections are formed in the draw bench, rolled or formed in a press. Simple shapes or sections should be used in designs.

The development of metal airplanes has been a slow process. In early days parts of other material were replaced by similar designs made of metal. This added only weight, if the same strength was maintained. Systematic tests on light metals resulted in the necessary formulas to estimate the possible load to be carried on thin sheets having curvatures, reinforced at certain intervals, designs that utilized every ounce of metal placed into the structure. Also corrugated sheets and skin stressed panels were the outcome of years of research and tests, conducted not only by laboratories but by most airplane concerns using metal construction.

Most of the primary structures in airplanes are subjected to bending and torsional stresses. This combination of forces leads to design of sections that have the material placed as far as possible from the neutral axes. This trend is indicated in cross sections of wings shown in Section 6, in which the heavy lines show the location of the sheet and shapes. The last sketch in Section 6 pictures a cylindrical metal spar, used also for storing fuel.

The first problem that confronted the designing engineer was the distance at which the thin sheet and fastened shape acted as one. This distance is called the effective width and is sketched in Section 7. The effective width of a curved panel decided on the distance between the bulkheads in a monocoque fuselage design or the necessary longitudinal stringers in a semi-monocoque fuselage. The curved panel idea is clearly seen in a cross section of a bird feather.

It does not suffice that the designer is well acquainted with the strength of a metal construction in shear, compression or torsion. He also must know the available stock of material and working limits of the shop equipment. This brings up the co-operation of engineering department and production department. The production department again will receive the cost of a new design from the cost estimating department. For example, in the two lower sketches in Section 8 two panels of the same strength are shown. One is made of corrugated sheet, the other of a reinforced panel; the panel shown on the right is cheaper.

Section 9 pictures the highly advertised geodetic design which was used long ago on masts of battleships. It seems that the geodetic design will be higher in man-hours than the regular semi-monocoque design. The advantage of the geodetic design is the dis-

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- ☐ Private Pilot
- ☐ Aircraft Factory Mechanic

tribution of stresses over a great number of diagonals, so that 60 to 80 per cent of the structure may be removed without collapse, if the original structure had a high factor of safety. This is easy to comprehend if it is compared with the conventional frame design shown in the lower sketch in Section 9. Removing one diagonal member, the frame would be without strength.

It is easy to reinforce a wood structure by gluing a piece to a finished frame. It also is a simple job to weld a lug to a steel structure with fair efficiency. However, an addition or replacement to an all-metal design depends on the shop equipment on hand. Some of the special tools pictured in Section 10 and Section 11 are used for forming and punching light metal. For small production, hardwood and rubber pads are used. For manufacturing, however, metal dies must be used. Even extra large bulkheads (Section 9) may be formed from a single sheet in a hydraulic press.

Some of the equipment is rarely seen outside an airplane factory. The designer must be acquainted with the workings and limitation of a saw, shear, router, profiler, shaper, nibbler, drawing bench, hydraulic press, power hammer, pressure rollers and spinning lathe. He should have records of available jigs and tools in order to design the best, easiest and the cheapest way. He must decide if a casting, forging, welded unit or a stamping should be used.

In case the designer lacks the necessary information they may be had in a short time by motion and time study (Taylor system) if a permit is granted by the shop management.

Producing a small quantity of metal airplanes, the units are built directly into the framework by a limited number of workmen that are interfering with each other. Only a few items such as wings or control surfaces are sub-assembled. In modern up-to-date line production, most of the units are produced away from the main structure. Wings are divided into sections (Section 13), controls are assembled into one unit (Section 12), the upper and lower halves of the fuselage are fully equipped and then fastened together. All assemblies are by gravity. Special shakeproof nuts and assembly tools are used. It may be said that the old-time aeronautical engineer had to *do* everything, but the present-day engineer must *know* everything.

END

Aircraft to Order

(*Continued from page* 31)

"The United States must reach South America by air, and provide means for South America reaching us, in faster time than Europe can reach South America." And: "There is only one way to maintain our air superiority on the world's oceans. That is to maintain superiority in equipment and servce."

The same thought was behind the construction of the long series of airplanes with which Pan American first spun its network of lines around the Caribbean, first bounded and criss-crossed South America, first succeeded the Alaska husky in carrying the mails, first bridged the Pacific and first established service to Europe on regular schedule.

The story of the company's research has been written in those airplanes. Topping the heap, in actual service today, is the Boeing "314," product of endless hours of engineering labor. The Martin "130" and the Boeing "314" were two steps in the direction of the ideal transport plane, almost side by side. Previous to that was the Sikorsky S-42, preceded in turn by the old Sikorsky S-40, with the great outriggers holding the tail surfaces. It was Priester, again, who argued for greater cleanliness of design in Sikorskys by doing away with those big booms which looked like a place for Mandy to hang the Monday wash. The Sikorsky outfit shook its collective head. The booms must stay. It was the only way the airplane could be built, especially in the larger weight classifications.

"So!" expostulated Priester.

Finally he got what he wanted—one airplane later.

The Lockheed and the Boeing will be stripped of their cellophane coverings this year and next and wheeled out on to the apron as fresh stepping-stones toward better airplanes. But now Pan American has refurbished its engineering policy. Heretofore, airplanes have been built to a purpose and an effort has been made to fit conditions to them. That is to say, the Boeing "314" was designed as a long-range boat with a cruising range big enough to fly around a storm area.

Now the process is being reversed. What the company learns from the new Boeings and Lockheeds will be utilized to build a plane which is indifferent to conditions. Pan American wants a transport which will serve the world traveler even more efficiently than a commuting train serves the straphanger. Snow will halt the train. Neither snow nor ice nor terrain nor distance must halt the Asia- or Europe-bound airliner which lifts off runway or water under the P. A. A. flag in the future. It must fly 4,000 miles between sunset and sunrise. It must cruise above 25,000 feet, where almost all "bad" weather can be avoided and it must deliver more than 300 m.p.h.

The Lockheed stepping-stone, a laboratory for the ship-to-come which will have a payload capacity of at least 10,000 pounds, is being built for speed; the Boeing stepping-stone for altitude. The two planes represent those elements which, it was found, it was impracticable for the moment to combine in the same design. Their performances represent not maximum, but minimum, elements from which the future plane—probably only two years away—must be developed.

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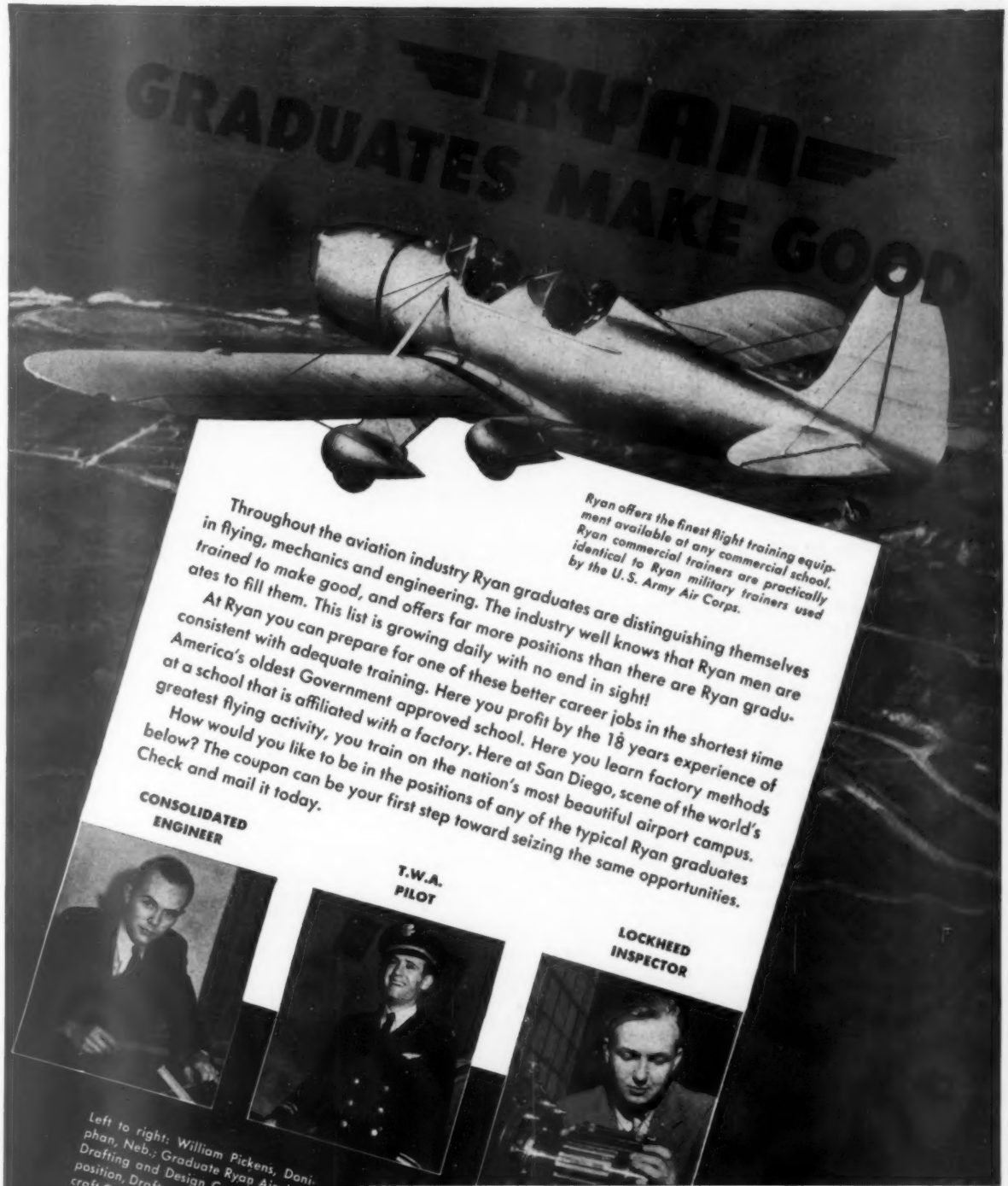

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and cockpit supercharging. The altitude at which Pan American is shooting is 24,000 feet, so the Boeing represents the first of two steps toward that goal.

The Lockheed will raise cruising speeds to the high speeds now currently available. In other words, the 260-odd m.p.h. which is the top in transport speeds will be the Lockheed's normal cruising speed. Since 300 cruising is P. A. A.'s goal and the Lockheed's top will be just short of that, the ship being built out in Burbank, Calif., is the first of a couple of steps toward the larger figure.

We asked Pan American, in its citadel at the corner of Forty-second Street and Lexington Avenue in the heart of New York, just how this optimum performance was going to be achieved.

"Three things," was the answer, "better propeller efficiency, higher wing loadings and more powerful, more efficient engines."

It is an interesting sidelight on the development of the new ships that Lockheed engineers had to submit four designs in succession before Priester was satisfied.

Both the Lockheed and the Boeing are landplane designs, of course, but the lessons learned from them will be equally applicable to any type of over-ocean aircraft the industry can build to meet Pan American's specifications.

It's a costly business, this development work. If anyone doubts it, he can juggle these contracts: Six Boeing "314-A's," an improvement on the big boats now on the Pacific and Atlantic, are on order. So are three Boeing "307's" landplanes, three Lockheed "44's" (the four-engine jobs), three DC-4's and 14 DC-3's. With the spares, they sum up to $11,000,000, cash on the barrel head—an amount which is the equivalent of all the current contracts of the domestic airlines for new equipment.

Trippe, Priester, C. V. Whitney and their tribe are building for a future free of the rattle of musketry, but they are acutely aware that the impetus which the conflicts in Europe and Asia will give to design and development work probably will make the task of maintaining American air superiority on the commercial air lanes that much harder.

Priester has taken that into account. He seems, in fact, to take everything into account.

It was fully six years ago that Priester began campaigning among propeller manufacturers for full-feathering blades. The manufacturers submitted exhaustive data to show that full-feathering simply was impracticable.

"Not by my figures," Priester said stoutly.

He won. Aside from his convictions about airplanes and his pride in his American citizenship, Priester has a positive mania for orderliness and a sublime faith in the technical superiority of his adopted land over the rest of the world.

Associates recall the time he trudged over to Brooklyn to load a P. A. A. motorboat aboard an ocean liner of foreign registry for shipment abroad. He returned fussing and talking under his breath.

"Those foreign ships, they are cleaner than American ships. The crews look neater than American crews."

That hurt his feelings.

END

Fulton of Akron

(*Continued from page 47*)

instructor. But Shorty was on hand to witness the flight and to grow reminiscent as he viewed the clean but faded overalls which his daughter donned.

"Those overalls belonged to Pete Johnson", Shorty told someone. "Pete was the first and one of the finest mail pilots who flew through here in the early years. One day when Pete and I were talking, he promised me that I would get his overalls if anything ever happened to him. Soon after that, the thing happened. Pete couldn't get through a storm one night and cracked up. Now Elynore has the overalls. We aren't superstitious about them."

Today Shorty is probably Akron's most famed aeronautical figure. His full name is Bain Ecarious Fulton and his position is that of Akron's airport manager. Some of his friends call him Little Napoleon, Tarzan, or Little Caesar. He is a man who always gets things done which he starts out to do. From an athletic viewpoint, one might suspect him to be a professional wrestler. From the contour of his underpining he might be an ex-cowboy. His normal conversation would put to shame that of a stevedore. Yet he is not considered profane. He is an aviator, engineer, inventor, botanist, doer and dreamer combined.

After his first parachute jump down in Kenton, he went to Texas and became an auto mechanic. He eventually was one of the first drivers of motorized fire engines in the state of Texas.

Shorty sold autos, repaired them and became a semi-professional race driver. It was during his Texas residence that he had his second contact with aviation. A flyer came to town with an airplane, prepared to set up a passenger-hopping business. Fulton helped him set up the plane as the town's leading mechanic. But when he went to go aloft in it, the ship only managed to rise three feet off the ground. It lost altitude so quickly that they had to give it up. The town was 3,600 feet above sea level and the plane had only a small motor.

Shorty came back to Ohio eventually to study agriculture at Ohio State university. But his mechanical bent still was uppermost and he soon was over in Akron as a mechanic for the Firestone company. Then he became a chief master mechanic at Goodyear and bought his farm. He also learned to fly in earnest. He turned his pasture into a landing field and cut down the orchard. He wouldn't listen to the folks who told him he could do better by raising a crop of potatoes. After he built

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his plane, he made a living asking folks to hop over the 800-acre flying field with him.

About the time Shorty was working on his first plane, Goodyear Zeppelin corporation was negotiating with German Zeppelin interests for American rights and later was looking for a site for an airdock.

"Build it just outside my orchard," he suggested to the powers-that-be. Already he was visioning that bumpy field of his as a mecca for heavier and lighter-than-aircraft. His field was only 10 minutes from town and within easy trucking distance of the Goodyear plants where the airship parts could be built. Eventually Shorty won—as he always wins—and his flying field was taken over after famed Zep commander Dr. Hugo Eckener had pronounced it perfect, along with the 800 acres that surrounded it. Then Shorty went on a tour of American airports, came back filled with ideas and rolled up his sleeves and went to work. Hills were leveled, the field was graded, steam shovels and tractors clanked.

More land was acquired and the hills to the right and left of it made it a natural bowl-shaped tract. The Fulton farmhouse had to be torn down and Shorty and his family moved to a nearby road. Then the enormous airdock rose at one end of the field, the largest building without interior support in the country today.

Finally out of that sea of mud came the present day Akron airport—a busy, up-to-date, well equipped mecca for airliners and air travelers. The airport never will be quite completed probably, so long as Shorty Fulton is at its head. Because always, this rotund stocky little fellow is devising new plans for it. He visualizes it as a sort of an American Templehof — the famed German airport that was built from the former Kaiser's parade grounds. Already the Fulton field has a skating rink, a toboggan slide and a ski jump at one side and a huge natural ampitheater is being constructed into Akron's first outdoor municipal stadium on one corner of the port.

Two airlines fly through on several trips daily. Hundreds of take-offs and landings are made on a fine Sunday. The international Soap Box derby has been conducted on the port for the past three years, now one end of it is known as "Derby Downs." Tourists' camps rise at the top of the port. Motorcycle races and model plane meets are held back of the Zep dock.

It is while explaining his dreams of a super-airport that Shorty takes his visitors careening round the airport in his doughnut-tired car. Up a hillside, dodging stumps, to the very brink of a precipice, down into a dugout, across the grass ground of the field, they go. Sliding down a 40-foot embankment, Shorty will still continue to enlarge on the wonders of his port, while his visitor grips the sides of the car and prays for a safe landing. They always arrive safely back at the administration building somehow and then, like as not, Shorty is off across the port again on his motorcycle to harangue with some WPA boss. His waking hours are spent solving airport problems and sometimes he even sits at his mahogany desk. His working hours are from sun-up to way past sundown. He is a camera enthusiast and his greatest sport is shooting pictures of his friends in unconventional poses at the airport.

The day when Elynore came to him and told him she was going to take flying lessons was a red letter day in Shorty's life. His son, the youngest of the family, is not old enough to fly yet, although he has been an entrant in the Soap Box derby races.

"I always wanted my girls to fly but they never showed much interest till this Government training program came up," he said. Shorty still flys some himself just to keep his hand in practice. If you ask about Shorty Fulton in any airport in the United States today you will get a flicker of recognition in the eyes of the man you query. If you mention Akron, most flyers will tell you its one of the best airports in the United States. The two names—Shorty Fulton and Akron Municipal airport—have become synonymous.

END

Uncle Sam's Secrets

(*Continued from page* 24)

taking photos of the wreck. Should the crash take place out in the countryside, away from a Government field, there is not much the Air Corps can do to prevent photography of the wreck, except to make a *request* that accredited news photographers not take certain close-ups. Photographers will usually respect the request, if they think it a reasonable one. The Air Corps and the press work closely together and many newswriters have some good feature stories under their hats, but withhold them because it would jeopardize the interests of the country or the Air Corps were they to give them publicity. After an airplane has been issued to a combat unit, photos of the plane are usually released to the public. Accredited reporters, photographers and other representatives of publicity agencies may be admitted to factories.

Oh yes, you're still sitting down with that tall glass and a couple of pals discussing this matter of the air defense of the country or New York, let us say. You've doped out a pretty good plan; hot stuff. Right out of your own heads. It'd make a swell layout for one of the picture magazines. Don't ever worry about getting in trouble with the authorities by writing it up, with drawings, diagrams and broad arrows showing where you'd put the A.A. guns and the pursuit planes. Chances are that the military experts of foreign powers have done the same thing and have done a much better job than you and your pals have. And the *real thing* is locked away in a safe, available only to those officers who have a good reason to consult it.

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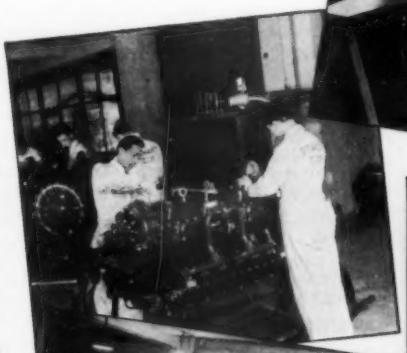

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AOPA News

(*Continued from page* 58)

local community poor. No municipality should be asked to do more than provide the ground and to maintain those buildings on it which serve the public convenience and necessity. By this we mean administration buildings, automobile parking areas, flight control towers and any other concessions essential to an airport. The municipality should be allowed to erect hangars if it wants and rent them to whomever it can, or it should be allowed to rent land about an airport for the erection of hangars and shops for those who want to use the airport for storage and repair base. Fundamentally, however, no municipality should be taxed with any development on an airport which will make that investment an unbearable burden. If the load for the development, maintenance and operation of a nation-wide airport system is properly allocated, everyone should be happy about it.

For AOPA Members

Since so many of our registered pilots fly cross-country and over the routes of established airlines, AOPA has recently arranged to have one of the large airline companies issue courtesy cards to all members not now possessing such cards. The courtesy cards will bear the pilot's name as well as his AOPA registration number as identification. Other arrangements are under way to help AOPA transient pilots.

The Dawn of a New Day

There is a new movement on foot which is heading up in the re-organized N. A. A. for a program of cooperation which will present a united front of all aviation for prosecution of common fundamental objectives which none of us can attain alone. This looks like sound common sense. There are too few of us in aviation to have much real weight in national affairs. We need a broad public backing. During past years, because there were no organized associations like AOPA, the N. A. A. had to face in every direction at once and that cannot be successfully done. Now, however, the special interests like ourselves are being well developed to do particular things for particular groups. Thus AOPA has only one interest—nonscheduled flying. *That is essential.* The new administration of the N. A. A. has published the fact that it wants every qualified person to join that *specialized* group which represents his interests and the N. A. A. will make *its* job the enlistment of *public interest* to help the special groups get what they need. Nothing could be sounder nor simpler. If it works, no one will be happier than we of the AOPA.

The National Aviation Forum

Thomas Beck of *Collier's* is chairman of the annual Forum to be held at the national capitol, May 27, 28 and 29. Sessions will be conducted in the auditorium of the Commerce Building and headquarters will be at the Willard Hotel. The plans contemplate the greatest outpouring of public support for aviation ever brought together. "The program," said Mr. Beck, "will be pointed straight at the American public and will not be another meeting where pilots go to sell each other on the need for air progress." Knowing the supercharged Mr. Beck, we would not miss the coming show for a new tail-wheel. Our own President Ludington has been asked by Mr. Beck to represent AOPA in the plans.

No Explanation Required

The following letter needs no editorializing:

Dear AOPA:

I have just read your AOPA NEWS and found it interesting . . . You state that 80% of all purchasers of private aircraft during the last 8 years sold their ships within 2½ years and did not buy others and you want to know *why*. Well, here goes.

Our experience . . . is that flying is just too dad gummed expensive from every angle for a working man. You have to be a millionaire or close to it to buy, operate and fly a private plane today. Our experience is that everybody connected with aviation (dealers, mechanics, operators of flying services, repair shops and everything) is in the same game to get all they can, and to gouge you and rob you right and left. They are killing private flying instead of promoting it by their all consuming *greed*.

I will detail a few items of exorbitant cost of flying that we ran into . . . We didn't know anything about flying but were determined to buy a plane and learn to fly it. We thought it could be done economically by three of us paying for the plane and expenses . . . A salesman came out from one of the nearby cities with the desire and determination to put the big pants on us. He sold us an early 37 h.p. 1936 lightplane for $950. We later heard that he had been trying to sell the same ship for $650 previously. We paid $400 cash down, and it cost us $155 to finance the balance of $550 for a year.

This is where the finance company got its whack at us.

The plane's final cost totaled $1105. The supposedly low financing amounted to 28 per cent interest—which is exorbitant in any man's language.

Well, we were all set to learn to fly and enjoy life in the blue sky. After we had the plane about a week and while one of the owners was taking dual instruction with a licensed instructor, immediately after take-off the motor quit and the plane made a perfect forced landing in a cotton patch. A condenser or coil in the magneto had burned out.

This should have been a minor repair, but we had to wait three days for a new condenser to come out of the city, and when it did come and was installed in the mag, the repairs amounted to $22. I thought this was expensive.

A little later on the motor needed a top overhaul, and we flew the ship back into the city for a top overhaul. This job is regularly done up north I understand for about $25. Well down here they added up a bill of $58 for the job. This job was not worth a dang, and inside of three more months with about 50 hours on the ship, we were forced to take it to another city for a motor overhaul. They did a pretty good job this time and added up a bill of $60.

After about 150 hours, it came time to relicense the ship. We flew into the city to be relicensed and worked over . . . and when the mechanic had finished, the bill amounted to the modest sum of $158. This was a good job, we will admit, but think the price was really high.

We kept the ship 18 months and sold it, and figuring gas, oil, airplane, repairs and other expenses, we figured that it cost each one of us $6 per hour to fly *our own ship*. We could have gone onto any airport in the country and rented a lightplane for $6 an hour, as that is the standard rate for a 40 h.p. ship around south Texas and elsewhere, I understand. . . . So from our experience, flying is just too darned costly for the average private flyer and private flying will not expand as it should until airplane prices, supplies, repairs, etc., are reduced to where a poor man can meet them. It has got to where a man who really wants to fly just can't do it, due to the double and triple price for everything connected with airplanes and aviation.

We still are crazy about flying, but have spent so much money in the past and have gotten so little out of it, that none of us feel that we can even begin to afford to own and operate even a light plane . . . at least not until they get down within the price of a moderate automobile and reduce repair costs and finance costs. BFW.

END

Propeller Dope

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U. S. N. R.

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By Charles S. Mattoon
Personnel Director Curtiss-Wright Corp.

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Such a record, and only such a record, could prepare a man to write a book of this nature. It is a book that will tell you how to find your place in Aviation. It will tell you the needs and the opportunities in Commercial Aviation, in Military Aviation, in Aircraft Manufacture, for Pilots, Engineers, Mechanics, and Apprentices.

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WAR...
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The European War has not completely eliminated the civilian radio engineer in England, but has provided him with many unusual and interesting jobs! Radio has been called upon to serve as *bomb detector* and *air raid precaution "sentinel,"* says E. J. G. Lewis, writing from London. Highlighted with many heretofore unknown revelations on what goes on "behind the censor," Mr. Lewis has written this authentic account on radio's new role in England . . . *exclusive* in the May Issue of RADIO NEWS. Read *"War and the English Service Engineer"* on page 61

RADIO NEWS

MAY ISSUE NOW ON SALE AT ALL NEWSSTANDS—25¢

Lady With Wings

(*Continued from page* 56)

off, head for Arlington, which wasn't lighted. But getting in was a cinch. I judged my altitude by a nice yellow haystack as I came into the field."

"One night I came over, set down after judging my altitude from the hay stack—and spread my undercarriage. Smack on the highest knoll." Evelyn was very unhappy. She was sure she'd lost her depth perception. Maybe her flying career was over. There had been the haystack and ——

But, no. The next day she discovered that the farmer had moved the haystack, leaving a lovely white patch which looked like a haystack. And she'd been judging her elevation by the ground. She heaved a deep sigh of relief and shelled out $30 for repairs to the undercarriage with almost a smile. She was that relieved to find out her eyes were okay, but that you couldn't trust farmers as far as they could pitch a haystack.

Then she moved to Beaumont. If you fly in California you know Beaumont. The fact that the field is 100 feet wide and 1,200 feet long is a little unnerving, but that isn't half of it. Beaumont is right at the head of dear little Gorgonio Pass, which is a nice, narrow vale between mountains which rise on one side to about 11,000 feet and almost as high on the other. Some people, who know, say it is the windiest spot in the United States. Others, who fly, say it is the windiest spot in the universe. It is negotiated with one hand on the stick, the other grasping firmly anything in the cockpit which won't break off or pull out and with the lips moving in silent prayer. In fact, it is the only place in the world where you can do acrobatics without moving a single control. Transient air, passing from cool valleys onto the desert to take the place of that which has been heated and has risen, boils, burbles, bounces, bubbles and backs up.

Into this plopped Evelyn and her *Cub* "40". One anecdote will suffice. "One day," says Evelyn, "I decided to fly down to Indio to do a little barnstorming. Before taking off I called Palm Springs and was told that all was well. So I started out with a student. We passed Palm Springs and saw what we thought were stratus clouds. They weren't. They were dust. Just about then we decided we'd better go home.

"So we headed back. We lost altitude. The wind hit us from one side and then the other. We drifted back and forth over the sagebrush. I should say bounced. A blast would get us and up we'd go. The blast would chop off and we'd drop a hundred feet. Pretty soon we were down pole high. And we were flying backwards. At times the motor was turning up as high as 2,900 r.p.m.'s. I saw that going further was impossible, when I was losing ground. So I started down the last few feet, flying all the way. I told the student that the moment we landed he was to pile out and grab the tail, holding it about shoulder high. A lot of cars had stopped along the highway, and I figured I could get somebody to help.

"I got down without even scratching the landing gear. The student held the tail, I held the gun open. People poured out of the parked cars and grabbed the struts. We just tied her down, tail into the wind. When the wind died, I got her to a garage on the highway, left her there, and the next morning took off the road and went home."

Another pilot had the same experience in the same storm. He got down, turned his ship around and the wind crushed ribs in his wings. He went home by truck. At Indio, the wind was reported at 90 m.p.h. "Often," Evelyn says, "I've taken off with a man holding each wing." That was swell experience. After a few months of it, Evelyn hopped her 60-year-old mother to Salt Lake City. Both liked the trip. And, last summer, when a new 50 h.p. *Cub* was needed, Evelyn talked her sister-in-law, Mrs. Victor Pinckert, into going to Lock Haven with her.

"We flew the job out," she says, "in 32 hours and 10 minutes."

The actual flight took four days, due to weather at Albuquerque. The girls were just taking it easy. They got near Pittsburgh late the first afternoon, decided to land at a small town nearby. They were greeted at the airport with:

"Gosh, you can't be girls? . . .

Evelyn took off in wind and rain at Albuquerque when told it was clear ahead, failed to find the clear stuff, came back in—and found that even airliners were on the ground.

"We stayed over a day," she says. "I'm no duck."

"Flying cross country," she adds, "is a lot of fun and adventure. But the airways need more accommodations. We felt like pioneers. We were shown a lot of courtesies because we were feminine. It would be even tougher on men."

Evelyn draws no fine lines of distinction as to whom she instructs. She has soloed a 50-year-old man and recently let a lad who has been helping her around the hangar go off alone in a *Cub* on his 16th birthday.

"The only thing that was handicapping the youngster," she says, "was his age."

The last time I visited Tri-City Airport there was quite a wind blowing. Clouds were scudding across the sky. A lone *Cub*, bobbing around in the wind, had been pulled inside the hangar. A comely brunette appeared, went to Evelyn's desk.

"It's 12 o'clock, Evelyn," she said. "Time for my lesson."

"Okay," Evelyn replied.

"Sort of rough, isn't it?" I said, with masculine reticence. I got a tolerant, wise smile.

"It's on days like this," Evelyn replied, "that you really learn how to fly an airplane."

I stayed to watch. Evelyn was right. She did a beautiful job of cool, precise flying. And when she soloes 'em, they know their stuff.

END

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Flying Inventor

(*Continued from page 46*)

used as a spare and a four-place Ryan for charter service.

Depreciation, salaries, insurance, etc., averaged $451.75 per month for the *Airbus*, $293.25 for the *Pacemakers* and $335 for the Stinson. Hourly operating costs (including maintenance and engine depreciation) were $10.50, $6.79, and $8.99 respectively. The monthly cost for the fleet was $2,847.95. In addition to this was a total monthly cost of $2,081.60 for operating a fleet of 12 delivery trucks. To break even with these costs would require about 1,100 packages a day at the average of 19.3 cents per package maintained by Tri-State experience. No month quite equaled this average, although by the end of the year they were within striking distance.

Until he became so preoccupied with All American's airmail feeder service which was described in the January issue of POPULAR AVIATION, Dr. Adams operated a produce company which shipped fresh sea food from coastal cities to Morgantown and fresh dressed poultry from Morgantown to Washington and Baltimore.

There is a wide fluctuation in daily loads in the same month, and from season to season. The daily average for December, 1938, was only 49.5 per cent of the high day. If express is the only revenue, ships must average about 80 per cent of capacity to make a profit. This indicates that feeder lines should be equipped with ships that will be heavily loaded on average days, with spares for rush periods. It also indicates the need for combining mail and express on the same trips.

With this experience behind him, Dr. Adams has just announced a very ambitious feeder service program for Tri-State which will extend operations east to New York and west to Chicago early this year. Express contracts are being negotiated with department stores and mail order companies in Chicago, New York, Detroit, Indianapolis, Cleveland, Columbus, Louisville, Dayton and other cities. A glance at the map will show how the new networks tie in with the old system and with the major airlines. It is too early yet to hazard a guess at the volume of additional airmail this system can feed into the trancontinental routes, but the area being blanketed is one of the most populous and prosperous in the entire nation. It is hoped that the carrying of both mail and express will be given, if the application is approved by the C.A.A.

Exact schedules have not yet been announced, but the general plan is for each flight to connect at least two points on major airlines. This makes for a more uniform loading all the way; on the first portion there will be more mail discharged than picked up, but as the second connecting point is approached, the volume picked up for feeding to the major airlines will steadily increase.

Tri-State's present fleet of five ships will, of course, have to be greatly expanded. Sixteen new airplanes will be needed; 14 for schedule and two for spares. The ships selected are twin-engined Bellancas of conventional design and the two-engined, single-prop Vegas. Ground equipment will be the same as that now used for transfer, but the load to be delivered will dangle from the grapple and be released after grapple strikes pick-up cable. This is necessary as a means of reducing landing shock when fragile articles are carried by express. (With mail only, delivery package is simply dropped as the plane passes over the ground station.)

Dr. Adams is by no means content to let things stop with this expansion. He sees feeder lines extending all over the country, but feeder service is only one of his many ideas. He thinks of aviation in terms of time and distance saved and sees the day when we will have flying milk wagons, hauling loads of a ton or more of milk at altitudes so high there will be no need for refrigeration. Time and refrigeration costs are so important that a flight of 200 miles can easily double the wholesale value of milk. Similarly he sees perishable fruits of the ordinary, rather than exotic, variety going long distances to market by air (such as Michigan fruit straight across Lake Michigan to Chicago, Milwaukee and points west). He believes that the pick-up and delivery device will be used for continuous shuttle service between

(*Concluded on page 95*)

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★ *June Issue*

South Sea STORIES

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Airy Chat

(*Continued from page 4*)

sequently, only a comparative handful of the air-minded public realizes that, for instance, a modern lightplane can fly about 26 miles per gallon of gasoline—at a cruising speed of 95 m.p.h. Which is better than the most economical automobiles. The solution, we believe, will come when the manufacturers stop "converting" salesmen to publicity men. The private flying industry sorely needs every inch of publicity it can get. There is no reason to expect that salesmen-turned-press agents will recognize a story when they see it. They haven't so far.

* * *

WE HAVE been wondering why we refer to the writer of this column as "we" instead of "I". Several readers have asked about it, knowing full well that M. K. is "me", not "us". At a loss for an answer we (or I) resorted to the dictionary, quote: "We is used for the singular I, by kings and other sovereigns, by editors as impersonal and by other writers as avoiding the appearance of egotism." Which is why I have been, and will continue to be, we.

* * *

NO END of surprises are coming from the War and Navy Departments these days. Just a few short months ago we hesitated mentioning a new military airplane for fear of revealing military secrets. Today things have changed. We hear of "the latest" fighter, developed to keep Uncle Sam supreme in the air. Then, before Uncle Sam ever gets the first airplane of that type, it has been "released for export"—which means for sale to Britain or France. For instance, we once regarded the Lockheed XP-38, Curtiss P-40, Bell XP-39, Grumman XF4F-3 and Brewster XF2A-1 as military secrets. Only to find that the Army and Navy have okayed them for sale abroad. Which is a situation we secrecy-minded Americans will have to get used to.

* * *

WHEN final page proofs of "Aircraft to Order" were okayed the other day, that article contained the latest information available. Then—this is the sort of thing that gives editors nervous indigestion—we discovered that Pan American Airways had beaten us to the newsstands. That company is about to sign contracts for some of the biggest landplanes in history. They will have four engines, tricycle landing gear and will be used on the San Francisco-Hawaii run. Planned flying time to Honolulu is slightly over nine hours. Our slide rule insists that that means a cruising speed of 265 m.p.h.

* * *

ALREADY on the fire for next issue is a fact-packed article on David R. Davis, the brilliant engineer who invented the highly efficient airfoil first used on the Consolidated Model 31 flying boat. This radically new wing (the Army Air Corps already has it on its latest B-24 four-engined bomber) has a fascinating story behind it. As you will see.

* * *

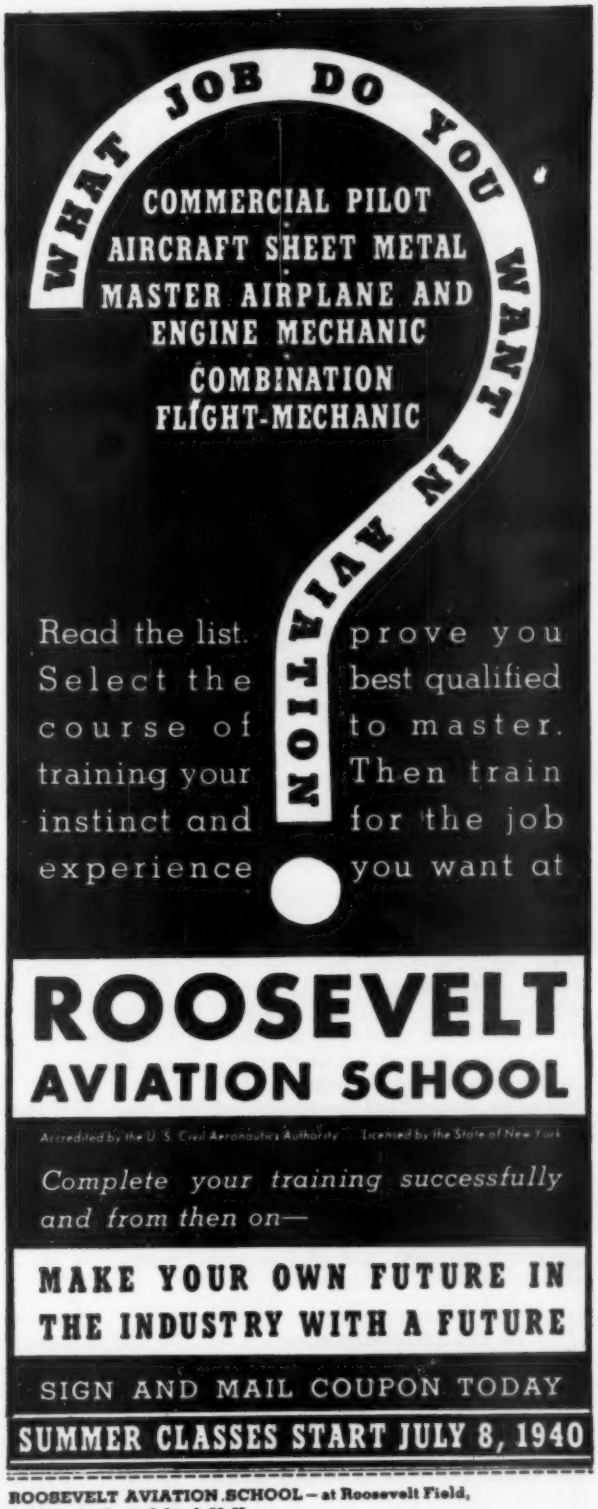
YOU'VE seen "by Edward Churchill" on P. A. articles so many times during the last year we think you're entitled to an explanation. He's a Hollywood writer who has been fascinated by aviation since the days of the famous Gates Flying Circus, for which he was advance man and publicity director. He has been writing aviation since 1925. New York, Chicago, Philadelphia and Peoria newspapers had access to the Churchill writing technique from 1921 to 1927. Then, until 1930, he toured the country with the aforementioned flying circus and one or two other air shows, including that of Clyde Pangborn and Hugh Herndon. In 1930 the Churchills turned up in Hollywood, where they have been ever since. Now a writer for Paramount, he writes almost exclusively for POPULAR AVIATION in his spare time; his by-line has appeared in every issue from February, 1939, to date. He's crazy about flying and is about to buy his own lightplane.

* * *

IF YOU'RE statistically inclined, you might like to know that this issue contains about 50,000 words, 99 photographs and 22 articles.

* * *

Plus 31 headaches. M. K.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Look Again, Pilot!

(*Continued from page 39*)

ditions pilots invariably come in to land at a good rate of speed. So Pilot No. 2 came in with nose well down and made gradual contact with the runway he thought he saw and when he didn't *feel* it he kept the plane in that position until he made contact with the *actual* runway.

Conversely, a pilot flying comparatively high and bucking a headwind all the way will invariably bring his plane in too slow, or just on the bare margin of a stall. He has accustomed himself to a sense of slowness in the plane he is handling.

Being in a hurry accounts for much grief. You hear the airport tower control man tell you to follow such and such a plane out and take off next after it. Then with your radio still on you hear him tell someone else to follow you. You want to get off right after Number One before Number Three gets too close on your heels. So you take off without the prop in high speed-low pitch, or the stabilizer is 'way back where it was when you landed, or the stick controls still are locked.

Which brings up the subject of doing things too automatically. Instinct and automatic action are all right in an emergency, but a deliberate landing is no emergency. All of us get too careless about our landings under certain conditions. This airport traffic control is one good thing to wake us up out of our trances before we straighten out for landing. Makes you move around in your seat to fiddle with the radio controls if you have one of those gadgets, or makes you watch for the green light beam otherwise. Might have saved me a big scare once. The sun had been shining hotly through the glass hood over the cockpit so I plastered a spare map there. The suction of air through the fine crack in the hood kept the map plastered overhead. Came in to land with it still there. I was about 15 feet off the ground and losing speed fast when the suction eased off enough to let the map down over my head and face. Luckily I cleared it just in time. But that reminds me about suction and cowls.

Seems like I heard something about a ship taking off through a ground fog one morning. An instrument take-off. About 30 feet off the ground when the co-pilot opened a side window. The pilot saw the rate of climb indicator shoot up, thought he'd pulled her up too steep and shoved forward hard on the wheel. He hit. What happened was that pressure builds up in the cabin on the take-off. When the co-pilot opened the window suddenly it was like going that fast from high pressure and low altitude to high altitude and lower pressure. That is, as far as the rate-of-climb indicator, or the pilot, knew. So the pilot, flying by instruments and guided by them, pushed the wheel, thinking to level her off. He already *was* level, so the ship nosed down sharply instead. Try it, you fellows with cabin jobs, and see if it doesn't work.

Why is it that if you look back of you for any length of time you invariably push forward on the stick? Or do the same when you pore too long over a map? One time I looked up from studying a map and found myself almost on the tree tops. Would have been better if I'd have left my hands *off* the stick if I had to poke my schnozzle down in the cockpit, rather than hold the stick and ease it the wrong way.

But we all do things like that. That is, if we do enough *different* kinds of flying. We do those things and if we're normally intelligent people we don't do 'em again. Experience*s*, I call 'em. They're what count in flying. Especially those you survive.

END

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Quiet, Please!

(Continued from page 28)

violinists who each can produce 70 decibels separately will only have an output of 73 decibels playing together. Hence a great deal of sound energy must be insulated from inside the airplane cabin before there is any noticeable decrease in the noise. In Table 1 are listed several every day conditions of sound production and their corresponding loudness, so that the reader can get a better understanding of this unit of measurement. An illustration of the various sources of sound in an airplane, and the amount each produces is found in the following figures: the propeller, having a tip speed of 650 ft. per second, produces 108 decibels; the exhaust, 104 decibels; engine clatter, 90 decibels; ventilator noise, 100 decibels; noise of the air flowing around the airplane, 80 decibels; and air-borne noise, 90 decibels. Total additive noise is 112 decibels. To provide a really quiet cabin this must be reduced to about 70 decibels.

It will be noted that the propeller is a great offender. For this reason there is great difficulty in soundpdoofing that part of the cabin between the airliner's two propellers. With four propellers bombarding the cabin on the new large transports the difficulties have multiplied. The fact that four-engined ships have been made as quiet as twin-engined planes is due to the careful study of the problems and the use of new and novel methods of insulating against this increased noise.

It is a known fact that, when tip speeds of propellers reach 1,100 ft. per second (which is the speed of sound) the noise becomes excessive. For instance, a certain propeller with a tip speed of 900 ft. per second had a sound level of 110 decibels. But, when this was stepped up to 1,130 ft. per second the noise level became 138 decibels. In addition to gearing the engines, the use of constant-speed propellers now enables the pilot to keep all propellers turning at the same speed, thus eliminating the harmonic beat due to constantly varying revolutions.

As has been mentioned, the use of all metal construction eased the sound engineers' problems by providing a covering that insulated more efficiently the outside noise. However, additional care must be taken with this structure to avoid vibration noises and the drumming of large panels of skin not sufficiently stiffened, thus setting up air waves. This is especially important near the propellers.

Three kinds of soundproofing material are in wide use today. There is the fireproof "Stonefelt", glass wool and flameproofed "Kapok". A varying treatment must be used in cabin walls from front to back as regards weight of material and texture. In contrast to the 30 lbs. of soundproofing used in early attempts, amounts now used range from 10 to 18 lbs. per passenger. Supplementing soundproofing used in the cabin walls are the much more lavish cabin furnishings (upholstery and curtains) that mark the modern airliner. Sound absorption by these items is an important consideration.

So far as engine clatter and exhaust noises are concerned, not much can be done at the source of sound. No successful exhaust silencer has yet been developed, largely because of the loss of engine power from back pressure. Only thing that can be done is to place the exhaust where it will affect the cabin the least.

Aerodynamic noises, due to airflow around the airplane, have been reduced by rapid advances in streamlining: the elimination of biplane wings, exposed struts, wires and landing gear. But, while this was being done, cruising speeds have been rising so rapidly that the element of noise again is becoming a problem.

The howl of air moving through heating and ventilating ducts has become an important problem in recent years. A controversy is in progress between proponents of the small duct carrying air at high speeds and those who believe a quieter operation would result from employment of larger ducts carrying air at lower speeds.

While paying great attention to passenger comfort, engineers also have recognized the importance of fatigue as it affects the efficiency of the crew. For this reason the control compartment is carefully soundproofed. The importance of such a measure is illustrated by a recent

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test made on clerical workers under varying conditions of noise. The increase of efficiency of an office where typewriters, adding machines and other noises were quieted and general acoustic conditions were improved, was 14 per cent better than could be expected from noisy working conditions.

TABLE I

Common Sound Conditions with Accompanying Decibel Equivalents

Decibel	*Sound Condition*
0	Threshold of Hearing
10	Rustle of Leaves in a Breeze
20	Quiet Whisper
30	Soft Radio Reception
40	Loud Whisper
50	Ordinary Conversation
60	Noise in Residential Street
70	Quiet Airplane Cabin
80	Motor truck or Loud Radio
90	Pneumatic Drill or Elevated Train
100	Riveting Machine or Noisy Airplane Cabin
120	Threshold of Feeling or Airplane Engine

In closing, it is interesting to note that new problems have been uncovered with operations in the substratosphere in pressurized cabins soon to start. But already thorough tests are being made at these lofty altitudes and a thorough program of research is providing the answers for this new operating condition.

END

Flying Inventor

(*Continued from page* 90)

outlying airports and downtown post offices and that, eventually, mail deliveries will be made directly to post offices by major airliners before stopping to unload passengers at airports. He has developed the mechanism for using the pick-up to stretch cables across impassable canyons. One of his latest developments is equipment for transferring fuel and other material to an airplane in flight by having the receiving plane pick up the edge of a parachute in which the other plane has dropped supplies (think of this for refueling Naval planes at sea)! Another application of the grapple is in military operation. A pursuit plane, with cable dangling, flies over an enemy bomber. The grapple catches, releases a trigger which drops a heavy weight attached to the cable; the weight drops in front of the bomber while the cable cuts through the wing. Consider that as a supplementary weapon for the high speed pursuit divers now in use by all armies!

There is one important thing about this flying inventor. His interests are varied and his inventions have followed his interests. Nevertheless, there is not a single Rube Goldberger in the group; visionary as some of Dr. Adams' inventions may have seemed when first announced, every one is practical. The future will determine whether his contributions to the healing sciences have done more to benefit mankind than his contributions to aviation.

END

Dr. Stalker

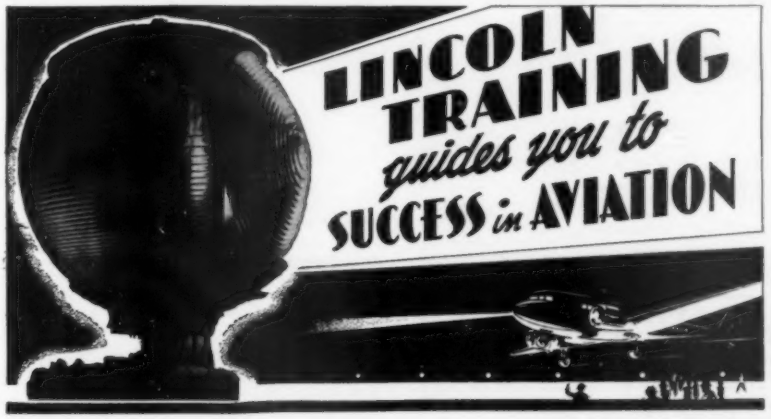
(*Continued from page* 44)

that the landing speed is slow, because it is then that lateral control is at the vanishing point."

"There are reasons to believe," he continued, "that a small amount of blowing and sucking (of air through the slots over the boundary layer) will improve the take-off and climb performance, so that in combination with the landing characteristic, an appreciable increase in payload will be made."

Whether the scientist can achieve all these things with the horsepower which he estimates is necessary is a question that only actual flight tests will determine. He says that experiments at the University of Michigan indicate that 3.5 h.p. is sufficient to obtain lift coefficients of about 4.5 on a wing 200 square feet in area and anticipates that the lift coefficient will be brought up to around 11 with eventual improvements in engineering. On the other hand, engineers who have looked over his paper have expressed the belief that 200 h.p. might be more like it in the average sized transport, but admit that even this required power might not be excessive in the case of a large transport. It must be pointed out, however, that Stalker has been engaged in developing his method for about 17 years and that his conclusions are based on actual tests,

(*Concluded on page* 97)



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CASH for photos, stories, articles. New Aviation Magazine. Will feature small field, flying club news. Details Dime. Davis, 48 North 7 Street, Newark, New Jersey.

WANTED: A party to finance me so that I may go to an aviation school. Jack Perkins, Freewater, Ore.

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(*Continued from page* 95)

whereas theirs were snap judgments.

Summarizing the benefits he believes will result from his method, Dr. Stalker asserts that boundary layer control will:

Multiply the lift some six times and correspondingly reduce the landing speed.

Provide lateral control under all conditions.

Eliminate the deadly spin as an involuntary maneuver.

Increase the high speed by reducing the wing area required.

Increase the payload several times over.

Prevent icing by heating the air circulating within the wing.

Naturally, you can't expect to enjoy all of these advantages at their maximum in any one airplane. Putting a controlled wing on the *Yankee Clipper,* for instance, and doubling or trebling the payload, increasing your cruising speed to 500 m.p.h., reducing the landing speed to 30 m.p.h. and cutting down on power by 50 per cent. But you can, if you have some particular reason for wanting to fly especially fast, reduce the wing area of your racing plane to a point where it will be increased tremendously in speed, but your landing speed will be as slow or slower than it was at your old high speed with your old wing. If someone wanted to fly faster than has been done yet he could do so by cutting down his conventional wing to a stub and catapulting the airplane into the air. But then his landing speed would be so high that he would need no less than the Sahara Desert to land in.

Or, if you're Pan American Airways and want to carry more payload across the Atlantic and Pacific than you are able to carry with your conventional wing-equipped clippers, you could install controlled wings and carry two or three times as many passengers and a similarly greater proportion of mail and express without any increase in power and cost of operation.

In the lightplane field, the chief value of the development is, of course, the elimination of spins and stalls. This should have a number of favorable results. One of the most important is that when spins and stalls cease to be involuntary maneuvers which kill inexperienced pilots, the public is going to start flocking into the air in even greater numbers. Second, the time required for dual instruction under existing regulations, based on the reasonable assumption that the average airplane will spin and stall, may be reduced and the cost of instruction will go down. This will help accomplish the first aim.

Dr. Stalker cannily refrained from predicting ultimate high speeds which may be expected with the control of the boundary layer. However, it might be pointed out that at the same meeting at which Dr. Stalker first announced his development, two Curtiss engineers predicted speeds in the 500 to 600 m.p.h. range in the next few years, employing conventional power plants and conventional aircraft designs. It's anybody's guess what might happen if these 500 and 600 m.p.h. ships were equipped with the Stalker boundary layer control.

Dr. Stalker's paper has created somewhat of a sensation in those aeronautical circles which were not aware of his experimentation. It may very well revolutionize commercial, military and sport flying. It has been successful in the wind tunnel but, after all, the true test will be in the performance of the two pursuit planes which are being manufactured now with wings on which the boundary layer is controlled by his method. If what he expects is realized, his name will have a secure place in aviation's hall of fame. Meanwhile, the aeronautical world is waiting and watching, some skeptically, more hopefully.

END

More Power to Them

(*Continued from page* 21)

Recently there have been developed methods of manufacturing a well-balanced aviation gasoline of approximately 85 octane, but because of physical limitations this anti-knock rating cannot successfully be raised much above 100, even with the addition of tetra-ethyl lead; 100 octane gasoline is now being used extensively in military airplanes, but its use in airliners is limited.

With Neohexane, a balanced gasoline of approximately 100 octane can be manufactured without the use of lead and, when lead is added, the octane can be raised to what would be comparable to 115 or more under present methods of testing. Since the present octane scale doesn't go above 100, new methods of measuring high octane are being perfected.

An airplane engine using 100 octane gasoline has a power output of approximately 25 per cent more than if 87 octane is used, while 115 octane gasoline would increase this power output more than 50 per cent. Thus, without increasing the cylinder displacement, two airplane engines using 115 octane gasoline will deliver as much as three engines using 87 octane. This additional power, obtained without increasing materially the weight of the plane, will increase airplane efficiency and can be used in many ways. It can be used as increased reserve power, thereby adding to the safety of air travel, or it can be used for increasing performance.

In developing Neohexane, the Phillips Company research staff found that it could not only be made from various raw materials occurring plentifully in crude oil and natural gas, but that these raw materials were present in such quantities to make commercial production feasible. It is now being manufactured in a small "pilot plant" in sufficient quantities for long flight tests which have been carried out for some time now. A plant for large scale commercial production is being built at Borger, Tex., in the heart of the Panhandle oil and gas field and the product is expected to be placed on the market within the next three months.

END

Wail of Two Cities

(*Continued from page* 34)

Ellenstein's back was against the wall and he was reiterating: "We will resist every effort to designate North Beach the eastern terminal" and the construction of North Beach is "an outstanding and extremely glaring example of utter provincialism."

LaGuardia could afford to smile. He twitted Ellenstein: "If Meyer would pay more attention to Newark and less to New York, perhaps he would not find himself in the pickle he is now."

"Meyer" wasn't making empty statements about the fight he would put up. He organized civic groups and instigated meetings of prominent citizens to protest the move of the airlines. He dug up figures showing the cost of airline operation out of North Beach would be far above that of Newark. He threatened to rent the new hangar to manufacturing interests and suspend airplane operations from his field. The old hangars were scheduled to be razed on completion of the new and he moved to have them torn down.

The New Jersey newspapers reflected Ellenstein's determination not to let New York have the airlines. They played up all stories featuring the drawbacks of North Beach and got statements from numerous authorities and business heads interested in Newark to the effect that the airlines would lose much business if they transferred their bases. Gill Robb Wilson, state director of aviation, called the North Beach inducement to the airlines "shoestring competition."

Seldom does a single issue remain a source of continuous irritation for over a period of two years. Public interest usually drags after the first few weeks and revives only at sensational developments. For that reason the friction between the city of 7,000,000 and the city of half a million inhabitants is phenomenal. The storm built up all during 1938 and reached a tremendous force during '39.

The fall of 1938 found developments coming fast. Ellenstein attacked the physical characteristics of the new port and Colonel Brehon W. Somervell, who was in charge of construction, declared in answer: "It is a physical certainty that North Beach will be the finest airport in the United States and, as far as I know, in the world!" October 6 the Board of Estimate authorized the first lease for hangar space to American for 10 years at $125,000 for the first year. October 25, C. R. Smith, president of American, announced plans for transfer of headquarters from Chicago. November 16, American, TWA and United signed contracts for space in a ceremony with city officials. LaGuardia called it his "most gratifying duty."

But Newark wasn't licked. Ellenstein still had powerful ammunition in his guns. He was saving it for a more propitious moment.

(To be concluded in the June issue.)

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